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Commercial Catch Sampling and Estimated Harvest by Sizes and Exoskeletal Ages of Red King Crabs 1960-86, Kodiak, Alaska

by

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PO Box 3-2000
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State of Alaska Steve Cowper, Governor

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Since 1960, approximately 100 ADF&G personnel have been involved with collecting, processing, and summarizing the Kodiak red king crab commercial catch and catch sampling data. Without their combined efforts this report would not be possible. I would like to dedicate this report to all the people who collected the catch sampling information by measuring nearly 161,000 king crab since 1960. This unheralded job was often performed under harsh weather conditions (i.e., driving rain, winds, snow, and freezing conditions) while at the same time working on slippery surfaces (i.e., boats, docks, and canneries) and occasionally dealing with irate or unhappy fishermen.

People deserving special recognition in providing the historical data base used in the report include: king crab shellfish managers Robert Simon, Dexter Lall, Martin Eaton, Melvin Morris, Peter Jackson, Louis Gwartney, Rodney Kaiser, and William Nippes, who supervised catch and catch sampling data collection; Guy Powell formulated statistical charts, stock definitions, and summarized harvest data by stocks; and Peter Jackson and Kenneth Manthey tabulated the catch sampling data in the 1960's and provided for its documentation in their 1969 report.

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ABSTRACT

This report documents the red king crab *(Paralithodes camtschatica)* commercial catch and Alaska Department of Fish and Game's catch sampling program which occurred from 1960-83 within Registration Area K, Kodiak, Alaska. Carapace length, exoskeletal age, date, statistical area and subarea, and sampling date were recorded for each king crab measured. Red king crabs in the catch samples were placed into exuviant and anexuviant exoskeletal categories, by 2-mm carapace length size groups from 129-222 mm, and summed by statistical areas and subareas into stocks for each fishing season. Estimates by 2-mm groups of the number of shell age of crabs harvested were calculated by applying the catch sampling percent frequencies to the number of crabs harvested by stock and fishing season. Estimates of commercial harvest weights were calculated by taking the estimated harvest numbers and applying the following weight function to the mid-points of the 2-mm size groups:

$$Wt(g) = 4.45174 \times 10^{-4} \ (CLmm^{3.11937});$$

where CL means carapace length. Numbers and weights of red king crabs harvested in Area K by fishing season from 1950-83 are included; catches since 1960 are also reported by stock.

A total of 160,570 red king crabs were sampled from the commercial fishery in Area K from 1960-82 by Alaska Department of Fish and Game personnel. The number of crabs sampled, on a percentage basis, by stock during this period was: Stock II 31%, Stock III 30%, Stock I 27%, and Stocks IV-VII 12%. The number of king crabs sampled equaled 0.2% of the 74 million harvested during this period. Since 1960, the number of king crabs harvested by stock on a percentage basis was: Stock II 39%, Stock III 31%, Stock I 22%, and Stocks IV-VII 8%. From catch samples of an entire fishing season, the lowest and highest percent composition of the harvest for recruits was 5% and 71%, and for postrecruits was 29% and 95%, respectively. Comparing total catch samples between seasons, exuviant postrecruits ranged from 38%-80% and anexuviant postrecruits from 20%-62%. Estimated total season harvest weights were derived by combining catch sampling length frequency data with size-weight functions and numbers of crabs harvested from fish tickets. These estimates were compared with the actual season total harvest weights revealing that 18 of 23 estimated weights were within 5% of those from actual season harvest totals.

KEY WORDS: Red king crab, *Paralithodes camtschatica*, Kodiak, Alaska, commercial catch sampling, harvest

INTRODUCTION

The primary objective of this report is to document the commercial catch and catch sampling of red king crabs *(Paralithodes camtschatica)* during 23 fishing seasons 1960-82 in Registration Area K, Kodiak, Alaska. The secondary objective is to document results of computer-estimated size structures of king crab harvested in Kodiak by stock and fishing season. When combined with stock size, the size structure data base will readily allow computer-generated estimates of instantaneous natural and fishing mortalities. Registration Area K (hereafter referred to as Area K or Kodiak) has as its northern boundary the latitude of Cape Douglas (58° 52′ N. lat.), its western boundary the longitude of Cape Kumlik (157° 27′ W. long.), and its seaward boundary the 549 m (300 fm) depth contour (ADF&G 1986). Only one previous report summarized catch sampling by 2-mm size groups by stock and season to estimate size frequencies and shell ages in Area K (Jackson and Manthey 1969). Results of that report have been updated herein.

Blue *(Paralithodes platypus)* and golden or brown *(Lithodes aequispina)* king crab have been harvested incidentally to red king crab from 1960-82 in Area K. Their catches were not distinguished from each other or red king crab, but it is estimated that the combined catch of blue and golden king crab catch seldom exceeded 18,144 kg (40,000 lb) annually prior to 1983 (pers. comm. G.C. Powell 1984). During the 1982/83 season, the catch of golden king crab was separated for the first time from red king crab and totaled 11,281 kg (24,891 lb). Hereafter in this report, the term king crab refers to red king crab only.

Although the focus of this report is on Kodiak's king crab fishery since 1960, a brief overview of the exploratory phase, size limits, gear developments and the catches of the 1950's is warranted to give the reader a more complete understanding of this fishery's history. Commercial explorations for king crab and development of initial markets occurred in the late 1930's and early 1940's. According to the Alaska Department of Fisheries (1954), "The first determined [U.S.] effort to exploit this resources was made in 1938 when the floating cannery ship TONDELEYO of the Pacific Fisheries and Trading Company operated at Kodiak Island, the Shumagin Islands, and the eastern Bering Sea." In 1940 and 1941, the U.S. Fish and Wildlife Service conducted exploratory king crab fisheries throughout much of Alaska including the waters around Kodiak Island. Their biological and food technology research aided the establishment of the U.S. industry (Alaska Dept. Fish. 1954). In 1941 the Fish and Wildlife Service, Bureau of Commercial Fisheries, as managing agency, established the first king crab regulations, requiring a hard-shell males only fishery with a minimum size of 139.7 mm (5.5 in) carapace width outside the spines. In 1949 the minimum size was increased to 165.1 mm (6.5 in) outside the spines and raised again to 177.8 mm (7.0 in) in 1963, where it has remained (ADF&G 1961; Nippes et al. 1982). A second season was conducted every year on larger crab starting with the 1974/75 season. For the first four of these second seasons, the minimum size was increased to 196.0 mm (8 in) then it was lowered to 183.4 mm (7.5 in) beginning with the 1978/79 season.

Three types of gear have been used in the Kodiak king crab fishery: tangle nets, otter trawls, and pots. Tangle nets were used frequently during the exploratory and developing period of the fishery but have been prohibited since 1955. They were regarded by fishermen as destructive to female and soft crabs (Alaska Dept. Fish. 1954). In 1960 otter trawls also became prohibited leaving pots as the only legal gear. Initial king crab pots were modified Dungeness crab pots with larger tunnels and tunnel eyes (Simon et al. 1961). Through a series of modifications in materials, king crab pots became much larger and heavier than the modified Dungeness pots. By the mid 1960's king crab pots measuring 213 x 213 x 76 cm (7 x 7 x 2.5 ft) weighing 295 kg (650 lb) webbed with 25 cm (10 in) stretch mesh had become the most commonly used commercial pots (Rothschild et al. 1970).

In 1950 catches of king crab were first officially recorded for Area K. With statehood in 1959, the Alaska Department of Fish and Game (ADF&G) gained management authority over king crab from the Bureau of Commercial Fisheries (Nippes et al. 1982). The 1950's was the fishery development decade, as the fleet and industry grew rapidly with expanding markets. Catches rose steadily from 29 tonnes (65,000 lb) in 1950 to 6,508 tonnes (14.3 million lb) in 1959 and totaled 19.6 thousand tonnes (43.3 million lb) for the decade (Table 1). Initial commercial catch sampling efforts in the Kodiak area occurred in 1954 and 1958 when approximately 5,900 and 2,500 crabs, respectively, were measured by personnel of the Alaska Department of Fisheries. Samples were taken from the major king crab fisheries around Kodiak. This data is still in its original form and never has been summarized. Further study of the catch data from the 1950's may increase the continuum of historical data useful in analyzing the population dynamics of Kodiak's king crab stocks.

MATERIALS AND METHODS

King crab catch samples were obtained primarily by ADF&G shellfish biologists from commercial vessels unloading their catch at processing plants. Supervisors trained biologists in measuring and shell-aging crabs. Most crabs were delivered to and sampled in the City of Kodiak. Additional samples were taken at plants located in Lazy Bay and Port Wakefield, while others were obtained wherever floating processors operated with ADF&G personnel aboard, e.g., Kempff Bay, Jap Bay, and Old Harbor.

Vernier calipers wre used to measure the lengths of the king crab carapaces to the nearest millimeter, from the posterior margin of the right eye orbit to the midpoint of the posterior margin of the carapace. Exoskeletal age of each crab was recorded as new, old, or very old according to the classification of Weber and Miyahara (1962). New-shell crabs, or exuviants, are defined as those crabs which retain their exoskeletons for a year or less. They typically have white ventral surfaces with relatively few scratches or abrasions from the ocean floor or from encounters with other crabs. Old-shell and very old-shell crab, termed anexuviants, have not molted for 13-24 and 25-36+ months, respectively. Ventrally, old-shell crabs have yellowish exoskeletons with a number of dark stained scratches. Very old-shell crabs have dark ventral surfaces from the combined appearance of yellowish exoskeleton color and several years of accumulated

scratches. Often, the dorsal surfaces of very old-shell crabs contains dark scratches and fouling organisms such as barnacles, hydroids, and bryozoans.

The purpose of sampling commercial catch is to delineate the size structure and shell-age composition of crabs harvested. Since 1960, managers had adopted varying sample sizes and data analyses goals; operational plans were not always prepared (Table 2). Despite these differences, all samples from 1960-62 included the following: date, harvest location and vessel, and the length and shell-age of each crab sampled. A complete set of forms used for commercial catch sampling from 1960-82 appears in Blau 1988.

In order to identify areas where marine species are harvested, three-digit geographic units, called statistical areas, were defined and drawn on charts (e.g., 251, 258, 291, etc.). Statistical areas were unique to each registration area in the state (i.e., Southeastern, Cook Inlet, Kodiak, Adak, etc.). Statistical areas were further divided into smaller areas termed statistical subareas. Each subarea was identified by two unique numbers so that a statistical area-subarea was defined by five numbers (e.g., 251-91, 258-81, 291-73). Fishermen were required to report their catch on fish tickets noting the statistical area and subarea(s) in which their catch was caught. From 1955-83 five different statistical charts were used by ADF&G to record commercial catch of red king crab (Figures 1-5). Dates, seasons of use, and differences between the statistical charts are summarized in Table 3.

Based on the migration patterns of nearly 7,000 red king crabs recovered from tagging experiments from 1954-62 in the Kodiak Island - Lower Cook Inlet region, it was observed that king crab "...appear to be organized into six populations..." (Powell and Reynolds 1965). Ironically the first chart delineating these populations or stocks, in that same publication, showed only five stocks (Figure 6). The six stock boundaries were delineated within that statistical areas and subsareas. It was noted that Stock IV was actually the southern portion of the Lower Cook Inlet king crab population and not an entire stock (ADF&G 1965). These stock boundaries remained unchanged for 9 years (Figure 7a). It was not until four years after their initial delineation in 1965 that the stock concept was defined in writing; "The crabs in each of these stocks are to be considered as groups, which generally do not intermingle with those from other stocks, and not as discrete biological populations..." (Jackson and Manthey 1969). In August 1973 with the use of a new statistical chart, two stock line changes were necessary since stock lines always followed statistical subarea boundaries (with the exception of the registration area boundary between Kodiak and Cook Inlet management areas). With the consolidation of 23 nearshore statistical subareas into six along the south side of the Alaska Peninsula, the line separating Stocks IV and V was moved northward (Figure 7b). Also the stock line separating Stocks II and III changed with the statistical line change between 257-82 and 257-83 (Figure 7b). In January 1977 Statistical Areas 291-62 and 291-72 were incorporated into Stock III because of the numerous tag recoveries made there, in deeper water, from legal crabs tagged shallower on the annual crab population surveys in the mid 1970's (Figure 7c). In addition the previous Stock IV's area was cut in half by a line between 262-85 and 272-90, thereby creating Stock VII (Figure 7c). Since 1965 the stock boundaries have remained constant between Stocks I and II, I and V, I and VI, and V and VI. The

number of stocks and their boundaries have remained the same since January 1977.

A listing, by stock, of all statistical areas and subareas for each statistical chart (Figure 1-5) is given in Blau 1988. It is important to note that location or size of a statistical subarea may have changed from chart to chart even though the number remained the same, e.g., 291 and its subareas and 258-60 (Figures 1 and 2) and 257-82 and 257-83 (Figures 3 to 5), etc. Due to the different configuration of statistical subareas on the first two statistical charts (Figures 1 and 2) compared with the latter charts (Figures 3 and 4), the boundaries between Stocks I, II, and III were delineated slightly differently between these sets of charts. The stock boundaries for the latter two charts are shown in Figure 7a.

In this report, crabs with old and very old exoskeletons were combined into the same category, anexuviants. Weight and numbers of king crab harvested were reported on fish tickets which included the landing date and statistical subarea(s) fished. ADF&G's commercial catch sampling program for king crabs recorded the following information for each crab sampled: carapace length to the nearest millimeter, exoskeletal age (new, old or very-old shell), date and statistical area and subarea where the crab was caught. Commercial king crab catches were summed by statistical subareas into stocks by fishing season in accordance with the statistical chart in use during each season. A table showing the statistical areas and subareas use during these seasons can be found in Blau 1988. Crabs' carapace lengths were combined into 2-mm size groups ranging from 129-130 mm to 221-222 mm. Total number of crabs sampled by 2-mm size groups, by stock, for the 1960/61 through 1968/69 fishing seasons were taken directly from the appendix tables in Jackson and Manthey 1969. From these same tables, numbers of exuviants and anexuviants by 2-mm size groups were calculated by taking the percentages provided for each of these categories and multiplying them by the total number of crab sampled in each stock summary. For the 1969/70 through 1982/83 seasons, catch samples were summed by statistical subareas into stocks and by fishing season in accordance with the latest stock definition (Figure 7c, and Blau 1988).

After catch samples were summed by 2-mm size groups by stock and fishing season into exuviants, anexuviants, and total crab sampled, the estimated number of crabs harvested for each 2-mm category was then calculated. First, the total number of crabs harvested by stock for each fishing season were taken from the commercial catch summary. The number of crabs harvested by stock equaled 100 percent of the "estimated" total number of crabs harvested. Then the percentage of crabs in each 2-mm catch sampling size group in the exuviant, anexuviant, and total crabs sampled categories were calculated. Multiplying the total number of crabs harvested by the percentages of crabs in each 2-mm size category (rounded to the fourth decimal place) yielded estimates of the number of crabs harvested in each size and shell age category.

A carapace length versus weight relationship was determined by doing a statistical analysis of carapace length-weight observations from 218 Kodiak male king crabs, to provide the estimated weight of crags at each 1-mm carapace length. This data set consisted of 106 legal and 112 sublegal male crabs measured and weighed on September 25 and October 25, 1963,

respectively from Chiniak Bay (G.C. Powell, unpublished data ADF&G, Kodiak, Alaska). The average weight of the 2-mm carapace length catch sampling size group was then multiplied by the estimated number of exuviants, anexuviants, and total crabs harvested in each respective size group. Estimated weights of commercial crabs harvested in each of these groups was then summed by stock, and the stocks summed into fishing season(s) total(s).

During five fishing seasons (1960/61, 1961/62, 1962/63, 1964/65, and 1967/68) one or more stocks had commercial harvest but no commercial catch samples collected from them. No estimates of weight or size structure of crabs captured from those stocks can be calculated. For season summaries (all stocks combined) the numbers of crabs harvested were combined from all stocks as were the catch sampling length frequencies from stocks that were sampled to yield estimates of the size and shell-age of crabs harvested for that season. Similarly in both the 1977/78 and 1981/82 second seasons, one or more stocks had no commercial catch samples. In these cases the size structure of crabs harvested in the second season was assumed to have the same respective size structure by stock of those crabs taken in the first season based on catch sampling results, except that only crabs greater than or equal to the second seasons minimum size limit were used.

There are a number of limitations to the data in the way they were collected or the method of summarization. Fishermen were on the honor system to report their catch by the correct statistical subarea(s) from which it came. Some fishermen have misreported or falsified the actual areas of their king crab catch on their fish tickets. From tag recoveries and dockside interviews with ADF&G personnel, some of the incorrect catch information has been corrected on the final fish tickets (Powell and Gray, unpubl. manus.). The weight of the crabs harvested is believed to be fairly accurate since that was the basis for payment to fishermen. Conversely, the number of crabs harvested was oftentimes not accurately reported by fishermen or processors or listed on fish tickets. In these cases ADF&G estimated numbers of crabs from known average weight-number relationships for various areas as derived from in-season catch sampling. Crabs which died prior to a sale between fishermen and processors were termed deadloss. Deadloss was uncommonly recorded prior to the 1974/75 season, hence the number and weight of crabs harvested prior to 1974/75 was higher than reported. Commercial catch and catch sampling data was not separated but combined as a unit for Stocks IV, V, VI, and VII. Both statistical subareas and stock lines changed during the 1960-82 period, hence commercial catch, catch sampling, and resulting estimates of harvest by stock are not directly comparable through time.

Average weights of crabs harvested vary by statistical subarea within a stock and fishing season. Catch sampling was not always conducted in proportion to the commercial catch by statistical subarea, hence combining all the commercial catch and catch samples may produce estimates of size structure which do not accurately reflect that of the stock as a whole. Incorrect shell-aging by catch samplers also was a problem, as assessed from king crabs tagged on the 1974-80 Kodiak annual crab surveys and recovered 1-6 months later in the commercial fishery. Under this situation, the biologists tagging the crabs were assumed to have aged the crabs correctly, since the crabs' exoskeletons were more easily distinguished in

the summer, especially new-shell crabs which have recently molted. Also the tagger was generally more experienced in shell-aging than the catch sampler.

RESULTS AND DISCUSSION

From 1960-85 approximately 74 million red king crabs weighing 281,570 tonnes (621 million lb) have been recorded as being commercially harvested from the Kodiak Registration Area (Table 4). The percentages of the total numbers and weights, respectively, of king crabs harvested by stock since 1960 are: Stock II 39% (38%), Stock III 31% (29%), Stock I 22% (25%), and Stocks IV - VII 8% (8%) (Table 5). The total commercial harvest of king crabs from Bristol Bay (Registration Area T) was the only area that exceeded that of Kodiak's king crab harvest since 1960. From 1960-69 Kodiak averaged the highest king crab catch in Alaska (Blau 1985a).

There are approximately 30,000 square nautical miles of ocean surface area in Registration Area K (Table 5 and Figure 5). Percent area by stock (Figure 7c) is as follows: Stock I - 39%, Stocks IV-VII - 28%, Stock II-17%, and Stock III - 16% (Table 5). Stocks I and IV-VII have large areas that would probably be classified as commercially unproductive or of low importance. It has been estimated that about 50% of the Kodiak area could be classified as commercially important (G.C. Powell unpubl. manus.). Based on commercial harvest per square nautical mile, Stock II followed by Stock III have been the two most productive stocks (Table 5).

Commercial king crab harvests from Stocks IV-VII since 1960 have been the least of any stock in Area K. These stocks also appear to encompass the least productive area in terms of catch on a square mile basis (Table 5). Examination of individual catches from Stocks IV-VII reveals that approximately 60% of the catch from these stocks from 1960-82 came from Stock V (individual catch data for Stocks IV-VII is not given in this report). The area in Stock V is relatively small (Figure 7) and when compared with its historic catch of king crab it has comparable productivity, on a per square mile basis, to that of Stock I-III. It's estimated that the number of catch samples collected from Stock V have been at least 60% of those collected from Stocks IV-VII.

Average weight of king crab harvested in Kodiak since 1960 has been 3.8 kg (7.8 lb) (Tables 4 and 5). Stock I has had the heaviest average crab, 4.3 kg (9.4 lb) and those which varied most from the historic Kodiak average weight (Table 5). Of the 445 legal king crabs which were tagged, molted, and recovered, around the Kodiak Archipelago from 1974-81; those from Stock I displayed a higher average growth rate than any other stock[1]. This is one reason why crabs from Stock I weigh more on the average than those from the other stocks.

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[1] ADF&G Kodiak office computer printout DFG59 entitled, "Measurement Bias, Growth and Probability of Molting Tables for King Crab," run date 3/19/83.

The harvest pattern of king crabs by season (Figure 8) has been closely mirrored by the harvest from each stock each season (Figure 9) (Blau 1985b). For example, when total season harvests are high or low, the harvest by each stock reflects this trend. Generally the harvest by stock each season is proportional to its historic ranking. Peak season harvests occurred during the 1961/62 through 1967/68 seasons (Table 4, Figures 8 and 9). Kodiak's record king crab catch of 42,833 tonnes (94.4 million lb) occurred during the 1965/66 season. The harvest dropped 88% to 4,940 tonnes (10.9 million lb) by the 1971/72 season (Table 4 and Figure 8). This decline was the largest decline, or population "crash," in the history of Kodiak's king crab fishery. Since 1971/72, there have been three seasons in which the harvest peaked near 10,886 tonnes (24 million lb) these were the 1974/75, 1975/76, and 1981/82 seasons (Table 4 and Figure 8). The 1981/82 season was the highest harvest in 14 years followed in 1982/83 by the lowest harvest in 24 years (Tables 1 and 4). The 1983/84 season never opened, a first since the Kodiak fishery began 33 years before. The 1981/82 to 1983/84 period is considered Kodiak's second population crash. Stocks have since remained depressed and the fishery was closed through the 1985/86 season. The 1985 annual Kodiak crab population survey revealed the lowest level of sublegal crab in 14 years; therefore, the legal population, as a result of natural mortality, was forecasted to decline for at least the next 4 years. Without substantial increases in recruitment for sublegal king crab in the Kodiak area in the near future, the reproductive power of the population to generate future generations of crabs, may decline to such levels that multiple generations of crabs may be necessary before recovery occurs (Schmidt and Blau 1986).

Irregular recruitment of Kodiak red king crab seems to be the norm as opposed to a cyclic or well behaved stock-recruitment type of recruitment pattern (Blau 1986). As mentioned previously, the pattern of harvest by stock has generally reflected proportionally the harvest from the whole Kodiak Registration Area (Table 4, Figures 8 and 9). Synchronous recruitment patterns may be a regionwide phenomenon as evidenced by the offspring from the 1970 and 1971 parent years which produced record survey abundance (since 1969) of king crab in the 1977 surveys conducted in the Cook Inlet, Kodiak, Alaska Peninsula, Dutch Harbor, and Bristol Bay Registration Areas (Blau 1985a). The strength of both these year classes was also responsible for the combined Alaskan king crab harvest record which occurred in the 1980/81 season. Environmental factors which control survival and recruitment of small king crab are poorly understood (Blau 1985a; Blau 1986). Effects of stock abundance, size structure and sex ratios on recruitment are also not well understood for crabs.

Results of 23 years of commercial king crab catch sampling (1960/61 through 1982/83 seasons) in the Kodiak Registration Area are summed by 2-mm size groups, shell-age, stock and fishing season in Blau 1988. A total of 160,570 crabs were measured and shell-aged by the ADF&G commercial catch sampling staff during this period with 31% of crabs sampled coming from Stock II, 30% from Stock III, 27% from Stock I, and 12% from Stock IV-VII (Table 6). If the goal of commercial catch sampling was to sample in proportion to the commercial harvest by stock, then in the 23 seasons fished, Stock I was oversampled 15%, Stock II undersampled 23%, Stock III oversampled 3%, and Stocks IV-VII oversampled by 50% (Tables 5 and 6).

The number of crabs sampled in one season ranged from 391 (1962/63) to 15,412 (1963/64) with the 23-year average of 6,981 crab measured per season (Table 6). No catch samples were taken in stocks 9% of the time during either the first or second seasons (12 out of 128 possibilities) (Table 6).

Quality of commercial catch sampling can abe examined in three important areas: (1) the accuracy of carapace length measurements, (2) shell-aging accuracy, and (3) the percentage of harvest occurring during the adult molting season when growth could occur. The accuracy of measurements and shell-aging has been assessed from 2,575 recovered tagged king crabs (Tables 7 and 8). Fifty percent of these crabs had the same carapace length measurements when tagged and recovered, whereas 42% had length differences of $\pm$2 mm and 1% $\pm$3 mm (Table 7). The overall standard error of these measurements was 0.88 mm which is within the $\pm$1.0 mm precision of the Vernier calipers used. Therefore, the catch sampling length meaurement data appears to be accurate within $\pm$1 mm. The study of shell-aging differences show that 4% of the new-shell, 11% of the old-shell, and 69% of the very old-shell crabs were identified as having different exoskeletal ages when recovered than when tagged with an overall error of 9% (Table 8). Molting of these crabs did not occur between the time of their tagging in summer and their subsequent recovery in the commercial fishery 1-6 months later. New-shell crabs are more difficult to distinguish from old-shell crabs when recovered in the fishery, compared to when they were tagged, as their exoskeletons became progressively darker with age and more scratched. Shell-aging errors of king crabs occurs in the catch sampling data and the reader is cautioned to bear this fact in mind when interpreting the shell-aging information presented, i.e., Table 9 and in Blau 1988. Additional data from Kodiak king crab tagging studies conducted in the 1950's, 1960's, 1981, and 1982 would contribute to a longer term summary of the accuracy of measurement and shell-aging errors.

Growth in crabs' exoskeletons results only after molting. Female king crab must molt before mating whereas males can mate either as exuviants or anexuviants. For all but the smaller adult king crab, the majority of mating occurred in March-May (Powell and Davis 1969; Powell et al. 1973). For the 1960/61 through 1968/69 seasons, the harvesting of king crab occurred during all or a portion of this mating period (Table 9) with March, April, and May accounting for 8.9%, 1.8%, and 0.9% respectively, or 11.6% combined, of the total poundage harvested (ADF&G 1970). Some of the crabs harvested during this time had molted. This may have increased the average length frequency for those fishing sesons. The number and length frequencies of crabs sampled during the molting months could be compared to those taken in the remainder of each of the fishing seasons. If these comparisons were done from the available catch sampling data a better estimate of the degree of bias due to in-season growth could be made.

Commercia catch sampling was the method utilized to estimate the size and shell-age composition of the commercial harvest by season. Based on crab composition from catch sampling, the lowest and highest harvest of recruits was 5% and 71% during the 1960/61 and 1971/72 seasons, respectively (Table 9). For postrecruits, 95% and 29% were the highest and lowest percentages of the number of crab harvested since 1960, again in the 1960/61 and 1971/72 seasons (Table 9). The highest average percent harvest of postrecruits occurred in the 1960's when harvests and average weights were

high (Tables 4 and 9). With the advent of second seasons, starting in 1974/75, the larger minimum size increased the postrecruit harvest for each respective season (Table 9).

An analysis by B. Alan Johnson, ADF&G biometrician, of the weight - length relationship of Kodiak male king crab yielded the following formula:

$$Wt(g) = 4.45174 \times 10^{-4}(L^{3.11937})$$

where Wt(g) = weight in grams and L = carapace length in millimeters (Figure 10). This formula was applied to carapace lengths and when combined with the estimated number of crabs harvested in each 2-mm size group yielded estimates of the weight of crab harvested by size, shell-age, stock, and season (Blau 1988).

Comparing the estimated weight of king crab harvested versus weights from fish tickets for each total season reveals that the estimated weights were greater than the fish ticket values in 14 of 23 fishing seasons (Table 10). Percent errors between the two sets of season end values ranged from 0.1% (1981/82) to 18.6% (1962/63) with 18 of 23 years having less than 5% error (Table 10). One reason that the percend error is noticeably higher during the 1962/63 season may be due to the lack of catch sampling in all stocks except Stock III; Stock III's average weight of crab is about 15% less than those of any other stock (Table 4). Estimated season total weights averaged 144,000 kg (317,000 lb) less than those for the fish ticket totals for 23 seasons (Table 10).

Estimated king crab harvest weights generated (Table 10 and Blau 1988) appear to be fairly reasonable and useful for approximating harvest weights by size. It is not possible to precisely evaluate their degree of accuracy since the number of crabs harvested, from fish tickets, is only an estimate in itself and not a precise count. Hence, the number of crabs harvested as reported on fish tickets is a variable of which the degree of accuracy may change yearly. This fact may explain in part why the estimated weights generated are both higher and lower than those generated from fish tickets (Table 10). Other reasons why the estimated king crab harvest weights may differ from those of the fish tickets are that the weight-length formula may not be reflective of the different average crab weights found through different times of the year and that it may not duplicate the various mixes of shell-age types through time.

Weighting catch samples with catch in a proportional manner using units smaller than stocks and re-examining king crab definitions are two areas of research which if pursued could improve the accuracy of data in this report. But due to the additional time required to improve the methodology in these areas, the decision was made to combine all commercial king crab catches with the size-age structures from catch sampling, by stock and season. This method may under or overestimate the size structure and estimated weight of crabs if the crabs are not of uniform size throughout the stock. Average weight and size of crabs can vary considerably between statistical subareas within the same stock during the same season, as much as 0.9-1.4 kg (2-3 lb); this is especially true in Stock I, and generally bays have smaller crab than adjacent ocean areas (Kaiser and Nippes 1979

and 1980; Nippes et al. 1981, 1982, and 1983). The size variation of crabs harvested within a stock is further complicated by the fact that catch sampling by statistical subarea was not always taken in proportion to the commercial catch in that subarea (Kaiser and Nippes 1979 and 1980; Nippes et al. 1981, 1982, and 1983). If the size frequency data from catch sampling were combined with the weight of crabs harvested by statistical subarea, or collections of subareas whose crabs' have similar size-weight structures, then more accurate estimates of size frequencies, shell-ages, and weights could be made compared to those given in Blau 1988.

The king crab stocks, as defined for Kodiak, have been useful for the purpose of summarizing commercial catch and catch sampling data from large geographical areas. It's recognized that these stocks may not be discrete biological units, since the extent of inter-stock larval drift or long-term migrations of these crabs are unknown. Currently, ADF&G is re-evaluating and updating historical migration information from tagging. Results of this study, and other possible future Kodiak king crab research into the patterns of recruitment, analyses of oceanographic currents, and biochemical genetic studies may alter stock concepts and boundaries which in turn may improve the quality of the data and it's analysis compared to that presented herein.

Catch sampling has been useful in documenting the sizes and exoskeletal ages of king crabs harvested in the Kodiak Registration Area. The catch sampling and harvest data presented in this report and in Blau 1988 provides and easily accessible data base for future analyses such as studies of instantaneous natural mortality.

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COSTS OF MANAGING FISHERIES RESOURCES

Alaska

Total Cost to the State of Alaska

The total cost of managing commercial fisheries in Alaska for FY-87 was calculated by adding together the estimated portions of the budgets of ADF&G and several other state departments which are associated with fisheries management (Table 19). Because many divisions and departments have multiple functions, it was difficult to separate costs associated with management of fisheries alone. Best estimates of the costs associated with fisheries were determined through discussions with knowledgeable staff in each department (Table 20). In each case the figures listed in Table 19 represent 100% of the respective budgets, except for ADF&G (percentages to be discussed in detail below), Office of International Trade (10%) and Fish and Wildlife Protection (65%).

As might be expected, the greatest general fund expenditures on fisheries management are associated with ADF&G ($34.2 million), followed by the Department of Public Safety ($7.5 million), and the Department of Commerce and Economic Development ($2.1 million). The estimated total expenditures for all departments in FY-87 was $45.2 million from general funds or $64.3 million from all funding sources combined. When expenditures on Sea Grant and the Marine Advisory Program of the University of Alaska are added, the totals come to $46.3 million (general funds) and $67.0 million (all funds). As a basis for comparison, approximately 1.6% of the total $2.145 billion in anticipated (restricted) general fund expenditures by the state of Alaska for FY-87 went toward fisheries management activities by ADF&G. The estimated general fund expenditures on fisheries management of all departments in FY-87 was 2.1% of the state total or 2.2%, when Sea Grant and Marine Advisory Programs expenditures of Table 19 are included.

Alaska Department of Fish and Game

Overview. Expenditures on fisheries management by the Alaska Department of Fish and Game were determined by summing the approximate expenditure from each division which was associated with fisheries. The estimated general fund appropriations expended on fisheries management cost for each division for FY-87 is listed in Table 21 (also see Table 19). In some cases this was difficult to do accurately, because some divisions perform both fisheries and game functions.

Total general fund expenditures by ADF&G on fisheries management were estimated for FY-76 through FY-87 (Table 22, Figure 13) using historical budget data and the same percentages used in Table 21. General fund expenditures were $11.8 million in FY-76, peaked at $43.0 million in FY-85, and declined to $34.2 million in FY-87. When these expenditures are adjusted for inflation using the Anchorage consumer price index, it can be shown that the FY-87 funding level is below the FY-81 level (Table 23, Figure 13). While actual funding of fisheries activities by ADF&G has increased 2.9 times from

Table 1. Catch of red king crabs from Registration Area K, Kodiak, Alaska, 1950-59.[1]

Fishing Year	No. Crab	Tonnes	Pounds[2]	Average Weight kg	Average Weight lb
1950	7,592[3]	29.4	64,882	3.9	8.5
1951/52	39,238	152.1	335,337	3.9	8.5
1952/53	58,021	263.0	579,707	4.5	10.0
1953/54	280,881	1,148.1	2,531,120	4.1	9.0
1954/55	320,059	1,130.2	2,491,536	3.5	7.8
1955/56	390,258	1,686.1	3,717,145	4.3	9.5
1956/57	699,281	3,182.4	7,015,988	4.5	10.0
1957/58	496,298	2,300.0	5,070,638	4.6	10.2
1958/59	695,782	3,237.6	7,137,529	4.7	10.3
1959/60	1,416,944	6,508.3	14,348,110	4.6	10.1
TOTALS	4,404,354	19,637.1	43,291,992	4.5	9.8

[1]Source of data: ADF&G 1954 and Simon et al. 1961.

[2]Weights for 1950-52 through 1959/60 season exclude catches from Shelikof Strait and the southwest portion of Kodiak Island.

[3]Only the weight of the crab was given for 1950. The number of crab was estimated by using the average weight of crab from the 1951/52 season and dividing it into the total weight from the 1950 season.

Table 2. Summary of operational plans for sampling red king crabs from commercial catches, 1960-83, Registration Area K, Kodiak, Alaska.

Fishing Seasons	Written Operational Plan	King Crab Manager	Desired Sample Size & Goals	Proposed Data Analyses
1. 1960/61 through 1968/69	No	Simon (1960/61) Lall (1961/62 through 1965/66). Morris (1966/67 through 1967/68). Jackson (1968/69).	From 1960-April 1965 sample sizes were not limited and ranged from 30 - 800 crabs. From May 1965 - April 1967, sample size was set at 100, thereafter reduced to 50 crabs per sample (Jackson & Manthey 1969).	--
2. 1969/70 through 1971/72	Yes	Jackson (1969/70 1970/71). Gwartney (1971/72).	50 crabs/sample. Two or more samples from single delivery. Ten samples/ month in Stocks I-III. Stocks IV-VI sampled when possible.	Submit for key-punching and and computer analysis at end of each fishing year.
3. 1972/73	Yes	Gwartney	30 crabs/sample/statistical area with a goal of 10 samples/month in each stock. No more than three samples per statistical area/month.	Monthly summaries with commercial landings weighted by samples to determine proportion of recruits and postrecruits.
4. 1973/74	Yes	Gwartney	30-50 crabs/sample. Samples taken only from vessels fishing only one statistical subarea. Maximum 200 crabs/each statistical subarea/year in Southern District. The maximum 200 crabs/month for each statistical subarea in the Northern and Shelikof districts.	Final analysis to be done at seasons end by Gwartney.

- continued -

Table 2. (p. 2 of 2)

Fishing Seasons	Written Operational Plan	King Crab Manager	Desired Sample Size & Goals	Proposed Data Analysis
5. 1974/75	No	Kaiser	50 crabs/sample/statistical subarea.	--
6. 1975/76 through 1976/77	Yes	Kaiser	50 crabs/sample/statistical subarea; 25 crabs from each of two different buckets. Total number of crabs to be sampled during the entire season was specified by stock or substock, i.e., 7,300 and 7,050 crabs to be sampled during 1975/76 and 1976/77 seasons, respectively.	After season, the number and percentage of recruit and postrecruits and then average weight will be summarized by statistical subarea and stock.
7. 1977/78 through 1978/79	Yes	Kaiser	50 crabs/sample/statistical subarea; 25 crabs from each of two different buckets. No limit on number of samples to be taken.	None mentioned in operational plans. Board reports summarized catch, sampling by stock, and first and second seasons. Percent new-shell, old-shell, recruit and postrecruits graphed.
8. 1979/80 through 1982/83	No	Kaiser (1979/80) Nippes (1980/81 through 1982/83)	50 crabs/sample/statistical subarea. No limit on number of samples to be taken.	Same as #7 above.

Table 3. Summary of statistical charts used for recording commercial catches of red king crabs, 1955-83, in Registration Area K, Kodiak, Alaska.

Statistical Chart Dates of Use	No. Crab Seasons Used	No. Statistical Subareas	Comments
Fig. 1 - Jan. 1955-May 1960	6	108	First Kodiak statistical chart used. In May 1961 nearshore statistical areas were developed primarily for reporting catches of finfish. Shelikof Strait statistical areas were included for king crab catches. Westernmost portion of the Kodiak Registration Area not shown on chart but includes Statistical Areas 262 (subareas 92-96) and 272 (subareas 60-80).
Fig 2. - June 1961-May 1963	2	93	Compared to the first chart, the second chart's statistical areas were nearly all renumbered and many were reshaped. Extensive offshore areas were added for the expanding king crab fishery. Chignik area within Kodiak registration area not shown on this chart included 262-85, and 272 (subareas 60, 64, 70, 72, 80, 90, 92 and 96). Note 291 subareas reversed numerically from north to south in Shelikof Strait compared with the previous chart.
Fig 3. - June 1963-Dec. 1964	1	168	This chart retained most of the nearshore numbering system of the previous chart, but offshore areas were renumbered and redrawn. Offshore statistical areas were drawn along increments of 50 fathom depth contours and were divided when the area they included became too large. This statistical chart included most of the red king crab habitat in the Kodiak area for the first time. An extra 258-96 (the outer one) was mislabeled by mistake. On the following chart it was correctly labeled 258-94. Catch was recorded in 252-79, an area outside this chart. This area was delineated on the following chart.

(continued)

Table 3. (p. 2 of 2)

Statistical Chart Dates of Use	No. Crab Seasons Used	No. Statistical Subareas	Comments
Fig. 4 - Jan. 1965-July 1973	9	164	This fourth statistical chart deleted the following areas which had been on the previous chart: Cook Inlet areas 248-40, 248-60, 249-20, 291-13, 291-14; deep offshore areas, 257-96, 257-99 and 258-99. This chart added 16 new areas including 14 in the Portlock Banks region and the offshore areas 252-67 and 259-66.
Fig. 5 - Aug. 1974-Dec. 1983	10	134	This was the first statistical chart designed and used solely for recording commercial shellfish landings within the Kodiak Registration Area. Bay statistical areas were modified to reflect depth contours. Mainland bays were lumped into six instead of 23 statistical areas as found on the previous chart. Areas 257-82 and 257-83 were realigned to a northeasterly-southwesterly direction.

Table 4. Red king crab commercial harvest by stock and season totals 1960-86, Registration Area K, Kodiak, Alaska.

Fishing Seasons	Minimum Size Limits[1]	Stock I		Stock II		Stock III		Stocks IV-VII		Season Totals	
		No.	lb (kg)	No.	lb (kg)	No.	lb (kg)	No.	lb (kg)	No.	lb (kg)
1960/61	6-1/2"	269,429	2,499,909 (1,133,941)	658,120	7,405,755 (3,359,198)	837,216	7,815,131 (3,544,888)	351,610	3,344,076 (1,516,849)	2,116,375	21,064,871 (9,554,876)
1961/62	6-1/2"	498,344	4,580,779 (2,077,809)	869,707	8,735,268 (3,962,256)	1,148,059	9,358,636 (4,245,011)	665,444	6,288,217 (2,852,291)	3,181,554	28,962,900 (13,137,366)
1962/63	6-1/2"	1,037,540	10,257,992 (4,652,952)	1,267,138	12,136,629 (5,505,089)	1,393,632	11,010,718 (4,994,384)	447,833	4,221,364 (1,914,781)	4,146,143	37,626,703 (17,067,206)
1963/64	7"	1,666,875	16,479,593 (7,475,027)	1,362,566	12,295,969 (5,577,364)	712,034	5,605,489 (2,542,610)	417,513	3,335,172 (1,512,810)	4,158,988	37,716,223 (17,107,811)
1964/65	7"	1,374,436	13,570,658 (6,155,554)	2,755,000	21,763,800 (9,871,905)	449,851	3,461,206 (1,569,978)	344,022	2,800,854 (1,270,448)	4,923,309	41,596,518 (18,867,886)
1965/66	7"	2,339,423	22,966,614 (10,417,493)	6,995,585	57,643,489 (26,146,678)	1,504,577	12,036,222 (5,459,545)	222,124	1,784,701 (809,528)	11,061,709	94,431,026 (42,833,244)
1966/67	7"	1,541,723	15,716,564 (7,128,922)	4,645,057	39,215,389 (17,787,822)	1,919,636	15,562,870 (7,059,207)	369,883	3,322,956 (1,507,269)	8,476,299	73,817,779 (33,483,221)
1967/68	7"	987,324	9,540,196 (4,327,365)	1,080,565	8,387,022 (3,804,294)	2,596,691	21,121,856 (9,580,724)	482,741	4,399,418 (1,995,545)	5,147,321	43,448,492 (19,707,928)
1968/69	7"	546,995	4,714,838 (2,138,617)	652,627	4,730,183 (2,145,577)	807,360	6,109,150 (2,771,067)	341,968	2,657,314 (1,205,339)	2,348,950	18,211,485 (8,260,600)
1969/70	7"	400,245	3,246,190 (1,472,449)	430,846	3,152,575 1,429,986	410,620	3,157,224 (1,432,094)	364,470	2,644,582 (1,199,564)	1,606,181	12,200,571 (5,534,092)
1970/71	7"	374,933	3,142,881 (1,425,589)	606,948	4,216,123 (1,912,403)	284,104	1,998,344 (906,435)	295,333	2,370,462 (1,075,225)	1,561,318	11,727,810 (5,319,651)

(continued)

Table 4. (p. 2 of 5)

Fishing Seasons	Minimum Size Limits[1]	Stock I		Stock II		Stock III		Stocks IV-VII		Season Totals	
		No.	lb (kg)	No.	lb (kg)	No.	lb (kg)	No.	lb (kg)	No.	lb (kg)
1971/72	7"	78,698	658,749 (298,804)	656,082	4,533,192 (2,056,224)	736,298	5,174,111 (2,346,940)	68,079	525,086 (238,175)	1,539,157	10,891,138 (4,940,143)
1972/73	7"	128,120	1,039,847 (471,667)	871,238	6,600,988 (2,994,161)	906,794	6,844,092 (3,104,432)	122,168	994,989 (451,320)	2,028,320	15,479,916 (7,021,580)
1973/74	7"	202,178	1,648,990 (747,970)	1,009,625	7,896,548 (3,581,818)	543,451	4,092,729 (1,856,433)	92,425	759,020 (344,286)	1,847,679	14,397,287 (6,530,507)
1974/75	7"	512,047	4,080,141 (1,850,723)	987,245	8,169,142 (3,705,465)	1,031,040	7,987,892 (3,623,251)	157,551	1,168,155 (529,867)	2,687,883	21,405,330 (9,709,306)
	8"	58,900	585,495 (265,576)	21,465	204,993 (92,983)	137,012	1,316,096 (596,972)	11,496	109,806 (49,807)	228,873	2,216,390 (1,005,339)
	Total	570,947	4,665,636 (2,116,299)	1,008,710	8,374,135 (3,798,448)	1,168,052	9,303,988 (4,220,223)	169,047	1,277,961 (579,674)	2,916,756	23,621,720 (10,714,645)
1975/76	7"	734,767	6,167,277 (2,797,433)	622,695	4,940,044 (2,240,769)	1,169,665	8,928,159 (4,049,750)	198,584	1,536,179 (696,800)	2,725,711	21,571,659 (9,784,752)
	8"	155,277	1,580,348 (716,835)	8,779	78,904 (35,790)	60,748	573,472 (260,123)	26,894	257,268 (116,695)	251,698	2,489,992 (1,129,443)
	Total	890,044	7,747,625 (3,514,268)	631,474	5,018,948 (2,276,559)	1,230,413	9,501,631 (4,309,872)	225,478	1,793,447 (813,495)	2,977,409	24,061,651 (10,914,194)
1976/77	7"	544,345	4,680,622 (2,123,097)	536,835	4,113,854 (1,866,015)	685,718	5,161,897 (2,341,400)	107,596	879,681 (399,017)	1,874,494	14,836,054 (6,729,529)
	8"	207,699	2,207,461 (1,001,289)	42,160	402,787 (182,701)	22,804	215,424 (97,715)	31,719	311,972 (141,508)	304,382	3,137,644 (1,423,213)
	Total	752,044	6,888,083 (3,124,386)	578,995	4,516,641 (2,048,716)	708,522	5,377,321 (2,439,115)	139,315	1,191,653 (540,525)	2,178,876	17,973,698 (8,152,742)

(continued)

Table 4. (p. 3 of 5)

Fishing Seasons	Minimum Size Limits[1]	Stock I		Stock II		Stock III		Stocks IV-VII		Season Totals	
		No.	lb (kg)	No.	lb (kg)	No.	lb (kg)	No.	lb (kg)	No.	lb (kg)
1977/78	7"	173,465	1,715,443 (778,113)	434,637	3,388,200 (1,536,863)	761,406	6,137,050 (2,783,722)	56,999	495,314 (224,671)	1,426,507	11,736,007 (5,323,370)
	8"	116,341	1,297,489 (588,532)	12,091	112,970 (51,242)	26,366	261,591 (118,656)	9,142	95,609 (43,368)	163,940	1,767,659 (801,798)
	Total	289,806	3,012,932 (1,366,645)	446,728	3,501,170 (1,588,106)	787,772	6,398,641 (2,902,378)	66,141	590,923 (268,038)	1,590,447	13,503,666 (6,125,167)
1978/79	7"	124,801	1,159,077 (525,749)	219,018	1,779,224 (807,043)	874,546	6,835,820 (3,100,679)	68,006	554,279 (251,417)	1,286,371	10,328,400 (4,684,889)
	7-1/2"	62,543	670,372 (304,076)	26,422	232,356 (105,395)	73,523	649,027 (294,394)	15,132	141,693 (64,271)	177,620	1,693,448 (768,136)
	Total	187,344	1,829,449 (829,825)	245,440	2,011,580 (912,438)	948,069	7,484,847 (3,395,074)	83,138	695,972 (315,688)	1,463,991	12,021,848 (5,453,025)
1979/80	7"	224,781	1,797,498 (815,332)	234,751	1,653,535 (750,032)	1,281,420	9,181,826 (4,164,811)	107,689	811,165 (367,939)	1,848,641	13,444,024 (6,098,114)
	7-1/2"	57,092	539,952 (244,918)	3,027	26,437 (11,992)	54,123	449,124 (203,719)	16,511	149,363 (67,750)	130,753	1,164,876 (528,379)
	Total	281,873	2,337,450 (1,060,251)	237,778	1,679,972 (762,023)	1,335,543	9,630,950 (4,368,531)	124,200	960,528 (435,689)	1,979,394	14,608,900 (6,824,119)
1980/81	7"	409,810	3,162,513 (1,434,493)	484,658	3,426,171 (2,204,763)	1,419,673	9,975,760 (4,524,934)	245,880	1,826,042 (828,280)	2,560,021	18,390,486 (8,341,794)
	7-1/2"	160,010	1,480,118 (671,371)	21,680	190,448 (86,386)	28,333	227,264 (103,085)	17,155	160,338 (72,728)	227,178	2,058,168 (933,570)
	Total	569,820	4,642,631 (2,105,864)	506,338	3,616,619 (1,640,473)	1,448,006	10,203,024 (4,628,019)	263,035	1,986,380 (901,008)	2,787,199	20,448,654 (9,275,364)

(continued)

Table 4. (p. 4 of 5)

Fishing Seasons	Minimum Size Limits[1]	Stock I		Stock II		Stock III		Stocks IV-VII		Season Totals	
		No.	lb (kg)	No.	lb (kg)	No.	lb (kg)	No.	lb (kg)	No.	lb (kg)
1980/81	7"	409,810	3,162,513 (1,434,493)	484,658	3,426,171 (2,204,763)	1,419,673	9,975,760 (4,524,934)	245,880	1,826,042 (828,280)	2,560,021	18,390,486 (8,341,794)
	7-1/2"	160,010	1,480,118 (671,371)	21,680	190,448 (86,386)	28,333	227,264 (103,085)	17,155	160,338 (72,728)	227,178	2,058,168 (933,570)
	Total	569,820	4,642,631 (2,105,864)	506,338	3,616,619 (1,640,473)	1,448,006	10,203,024 (4,628,019)	263,035	1,986,380 (901,008)	2,787,199	20,448,654 (9,275,364)
1981/82	7"	717,590	6,047,174 (2,742,955)	873,359	6,422,151 (2,913,042)	855,825	6,351,701 (2,881,087)	205,004	1,519,512 (689,240)	2,651,778	20,340,538 (9,226,324)
	7-1/2"	340,703	3,505,526 (1,590,082)	16,351	151,406 (68,677)	11,848	112,488 (51,024)	14,994	127,643 (57,898)	383,896	3,897,063 (1,767,680)
	Total	1,058,293	9,552,700 (4,333,037)	889,710	6,573,557 (2,981,719)	867,673	6,464,189 (2,932,110)	219,998	1,647,155 (747,138)	3,035,674	24,237,601 (10,994,004)
1982/83	7"	426,061	3,930,418 (1,782,810)	207,200	1,661,140 (753,481)	143,474	1,080,107 (489,929)	118,506	900,930 (408,655)	895,241	7,572,595 (3,434,875)
	7-1/2"	72,535	788,874 (357,828)	29,850	254,672 (115,517)	5,360	49,336 (22,378)	4,662	39,393 (17,868)	112,407	1,132,275 (513,592)
	Total	498,596	4,719,292 (2,140,637)	237,050	1,915,812 (868,999)	148,834	1,129,443 (906,479)	123,168	940,323 (426,524)	1,007,648	8,704,870 (3,948,467)

(continued)

Table 4. (p. 5 of 5)

Fishing Seasons	Minimum Size Limits[1]	Stock I		Stock II		Stock III		Stocks IV-VII		Season Totals	
		No.	lb (kg)	No.	lb (kg)	No.	lb (kg)	No.	lb (kg)	No.	lb (kg)
1983/84	*	*	*	*	CLOSED	SEASON	*	*	*	*	*
1984/85	*	*	*	*	CLOSED	SEASON	*	*	*	*	*
1985/86	*	*	*	*	CLOSED	SEASON	*	*	*	*	*
TOTALS		16,545,030	155,459,598 (70,515,371)	28,643,327	235,921,364 (107,012,258)	22,893,207	178,841,812 (81,121,378)	5,999,133	50,532,553 (22,921,208)	74,080,697	620,755,327 (281,570,215)

[1] Commercial fishing regulations have been published each year by ADF&G since 1960. Therein are contained the minimum size limits for red king crabs in the Kodiak Registration Area for each season, as shown above. These sizes convert to the metric system as follows: 6 1/2" = 165.1 mm; 7 1/2" = 183.4 mm; and 8" = 196.0 mm.

Notes: Boundaries for one or more stocks (II-V and VII) have changed slightly through time but remained the same during the following periods: 1960/61 through 1968/69, 1969/70 through 1970/71, 1971/72 through 1972/73, 1973/74 through 1974/75 and 1975/76 through 1982/83. Commercial king crab catch data, by stock, has been summarized using the stock definitions during these respective periods. ADF&G fish tickets compose the basic source of this table's data. Boundaries for Stocks I and VI have remained constant, hence data for these stocks have been comparable, respectively, through time. King crab deadloss is included in the above harvest data since the 1974/75 season. Prior to this time deadloss was inconsistently recorded, therefore the harvest from previous years is greater than indicated. Deadloss during the peak harvest years was estimated to be 5-10% of the harvest which is not included above (Lechner, pers. comm.). Prior to 1971/72 season small catches from the Kilokak Rocks to Cape Kumlik area were not included in the totals for Stocks IV-VII. Harvest totals included brown and blue king crab, which were not identified by species on fish tickets, but were estimated to seldom exceed 18,144 kg (40,000 lb) in any season (pers. comm. G. Powell 1984). In 1982/83 the catch of brown kings was 11,290 kg (24,891 lb) and summed separately; their totals are excluded above for that season. Table date 1/20/88.

Table 5. Summary of commercial catch statistics for red king crabs by stock, for 26 seasons (1960/61 through 1985/86) in Registration Area K, Kodiak, Alaska.

Stock	Number Statistical Subareas (Figure 5)	Square Nautical Miles	% Kodiak Area	King Crab Harvested		Wt. of King Crab Harvested			Average Harvest/Season			Avg. Crab Wt.	
				No. x 10^6	%	Tonnes x 10^3	lb x 10^6	%	Tonnes x 10^3	lb x 10^6	%	(kg)	lb
I	52	11,737	39.4	16.5	22.3	70.5	155.5	25.1	2.7	6.0	25.1	4.3	9.4
II	22	4,967	16.7	28.6	38.6	107.0	235.9	38.0	4.1	9.1	38.1	3.7	8.2
III	17	4,760	16.0	22.9	31.0	81.1	178.9	28.8	3.1	6.9	28.9	3.5	7.8
IV - VII	42	8,306	27.9	6.0	8.1	22.9	50.5	8.1	0.9	1.9	7.9	3.8	8.4
TOTALS	134	29,770	100.0	74.0	100.0	281.5	620.8	100.0	10.8	23.9	100.0	3.8	8.4

Table 6. Number of male red king crabs sampled by stock and season totals, from commercial catches, 1960-86, in Registration Area K, Kodiak, Alaska.[1]

Fishing Year		Stock I	Stock II	Stock III	Stocks IV-VII	Season Totals
1960/61		0	907	168	0	1,075
1961/62		0	2,117	2,791	2,160	7,068
1962/63		0	0	391	0	391
1963/64		0	9,930	4,611	871	15,412
1964/65		798	1,555	1,275	568	4,196
1965/66		3,002	5,300	1,473	212	9,987
1966/67		1,101	4,099	2,100	300	7,600
1967/68		247	600	2,000	0	2,847
1968/69		1,556	1,943	798	650	4,947
1969/70		2,021	1,597	1,197	1,196	6,011
1970/71		2,372	1,598	1,549	1,848	7,367
1971/72		595	1,865	2,099	398	4,957
1972/73		779	963	631	718	3,091
1973/74		711	2,206	1,371	322	4,610
1974/75	First Season	5,125	2,562	2,659	2,393	12,739
	Second Season	496	50	820	53	1,419
	Total	5,621	2,612	3,479	2,446	14,158
1975/76	First Season	3,022	1,922	2,421	250	7,615
	Second Season	1,206	546	50	149	1,951
	Total	4,228	2,468	2,471	399	9,566
1976/77	First Season	2,415	1,993	1,703	947	7,058
	Second Season	1,092	245	137	195	1,669
	Total	3,507	2,238	1,840	1,142	8,727
1977/78	First Season	1,968	1,733	1,344	636	5,681
	Second Season	582	50	71	0	703
	Total	2,550	1,783	1,415	636	6,384
1978/79	First Season	1,602	1,059	3,764	614	7,039
	Second Season	328	151	203	102	784
	Total	1,930	1,210	3,967	716	7,823
1979/80	First Season	1,237	387	2,765	519	4,908
	Second Season	298	100	502	36	936
	Total	1,535	487	3,267	555	5,844
1980/81	First Season	3,495	1,621	5,675	1,893	12,684
	Second Season	1,819	102	150	250	2,321
	Total	5,314	1,723	5,825	2,143	15,005
1981/82	First Season	2,081	1,884	2,530	918	7,413
	Second Season	283	0	0	0	283
	Total	2,364	1,884	2,530	918	7,696
1982/83	First Season	2,418	695	885	1,047	5,045
	Second Season	462	202	49	50	763
	Total	2,880	897	934	1,097	5,808
1983/84		* * *	C L O S E D	S E A S O N	* * *	
1984/85		* * *	C L O S E D	S E A S O N	* * *	
1985/86		* * *	C L O S E D	S E A S O N	* * *	
GRAND TOTALS		43,111	49,982	48,182	19,295	160,570
PERCENTAGE OF TOTAL		27%	31%	30%	12%	100%

[1] Commercial catch sampling data for 1960/61 through 1968/69 seasons from Jackson and Manthey 1969. The remainder of the data from edited and corrected commercial catch sampling data files as of March 1986 crab research and data processing offices, ADF&G, Kodiak.

Table 7. Comparison of carapace length measurements from male red king crabs tagged on 1974-80 annual Kodiak crab surveys and their subsequent in-season recovery one to six months later in the commercial fishery.[1]

Release Carapace Length(mm)	Measurement Differences: Recovery Minus Release Length (mm)							Recoveries	Standard Deviation
	-3	-2	-1	0	+1	+2	+3		
139 - 140	0	0	0	1	0	0	0	1	0.00
141 - 142	0	0	0	0	0	0	0	0	0.00
143 - 144	0	0	1	2	2	0	0	5	0.84
145 - 146	0	0	3	13	3	1	0	20	0.72
147 - 148	0	0	3	27	14	2	0	46	0.67
149 - 150	0	2	8	54	28	5	0	97	0.77
151 - 152	0	3	12	63	29	4	1	112	0.81
153 - 154	0	3	26	69	35	8	0	141	0.86
155 - 156	1	3	23	68	49	9	0	153	0.89
157 - 158	1	1	23	91	45	7	3	171	0.86
159 - 160	0	3	26	86	38	6	4	163	0.90
161 - 162	2	3	18	87	54	7	0	171	0.85
163 - 164	2	3	49	100	50	7	1	212	0.89
165 - 166	0	4	27	92	55	2	1	181	0.79
167 - 168	1	6	29	81	40	5	2	164	0.92
169 - 170	2	3	22	84	59	7	1	178	0.88
171 - 172	3	6	24	80	38	9	2	162	1.01
173 - 174	1	2	19	63	31	6	0	122	0.86
175 - 176	1	5	28	54	33	3	0	124	0.91
177 - 178	0	3	19	49	28	1	0	100	0.80
179 - 180	0	3	9	31	18	5	1	67	0.99
181 - 182	1	4	9	26	17	4	1	62	1.11
183 - 184	0	2	6	21	12	3	0	44	0.92
185 - 186	0	3	8	16	7	0	0	34	0.88
187 - 188	0	1	1	10	3	1	0	16	0.89
189 - 190	0	0	1	5	3	0	0	9	0.67
191 - 192	0	0	5	2	0	0	0	7	0.49
193 - 194	0	1	0	2	0	1	0	4	1.63
195 - 196	0	0	0	0	1	0	0	1	0.00
197 - 198	0	0	1	3	0	0	0	4	0.50
199 - 200	0	0	0	2	0	0	0	2	0.00
201 - 202	0	0	0	1	0	0	0	1	0.00
203 - 204	0	0	0	0	0	0	0	0	0.00
205 - 206	0	0	1	0	0	0	0	1	0.00
Total	15	64	401	1,283	692	103	17	2,575	0.88

[1] Data from ADF&G Kodiak office computer printout DFG 58 run date 05/06/80. Both release and recovery measurements made by ADF&G personnel. Less than 1% of the crab had measurement differences greater than ±3 mm, therefore these were excluded from this data set.

Table 8. Comparison of shell-aging between male red king crabs tagged on 1974-80 annual Kodiak crab surveys and their subsequent in-season recovery 1-6 months later in the commercial fishery.[1]

Release Carapace Length (mm)	New-Shell Releases (n=1,498) ** Recovered As ** New	Old	V.Old	Percent Error	Old-Shell Releases (n=1,007) ** Recovered As ** New	Old	V.Old	Percent Error	Very Old-Shell Rel.(n=70) ** Recovered As ** New	Old	V.Old	Percent Error	Recoveries
139-140	1	0	0	0	0	0	0	0	0	0	0	0	1
141-142	0	0	0	0	0	0	0	0	0	0	0	0	0
143-144	2	0	0	0	0	3	0	0	0	0	0	0	5
145-146	13	1	0	7	1	5	0	17	0	0	0	0	20
147-148	31	3	0	9	4	8	0	33	0	0	0	0	46
149-150	72	3	0	4	2	19	0	10	0	1	0	100	97
151-152	74	1	0	1	4	33	0	11	0	0	0	0	112
153-154	94	1	0	1	5	39	0	11	0	2	0	100	141
155-156	96	1	0	1	3	50	0	6	0	2	1	67	153
157-158	107	6	0	5	8	46	1	16	0	1	2	33	171
159-160	98	2	0	2	7	53	1	13	0	1	1	50	163
161-162	99	2	1	3	5	63	0	7	0	1	0	100	171
163-164	114	4	0	3	15	73	1	18	1	3	1	80	212
165-166	94	6	1	7	3	72	1	5	0	2	2	50	181
167-168	93	3	0	3	8	56	1	14	0	2	1	67	164
169-170	86	5	1	7	8	66	2	13	0	9	1	90	178
171-172	76	5	0	6	7	69	1	10	0	3	1	75	162
173-174	63	2	0	3	3	49	1	8	0	3	1	75	122
175-176	60	2	1	5	3	49	1	8	0	6	2	75	124
177-178	52	2	0	4	5	34	0	13	0	4	3	57	100
179-180	29	2	0	6	1	30	0	3	0	3	2	60	67
181-182	22	0	0	0	4	32	1	14	1	1	1	67	62
183-184	21	1	0	5	1	18	2	14	0	0	1	0	44
185-186	19	0	0	0	0	11	0	0	0	2	2	50	34
187-188	8	1	0	11	1	6	0	14	0	0	0	0	16
189-190	4	0	0	0	0	5	0	0	0	0	0	0	9
191-192	5	1	0	17	0	1	0	0	0	0	0	0	7
193-194	2	0	0	0	1	1	0	50	0	0	0	0	4
195-196	0	0	0	0	0	1	0	0	0	0	0	0	1
197-198	3	0	0	0	0	1	0	0	0	0	0	0	4
199-200	0	0	0	0	0	2	0	0	0	0	0	0	2
201-202	0	1	0	100	0	0	0	0	0	0	0	0	1
203-204	0	0	0	0	0	0	0	0	0	0	0	0	0
205-206	1	0	0	0	0	0	0	0	0	0	0	0	1
TOTALS	1,439	55	4	4	99	895	13	11	2	46	22	69	2,575

[1] Data from ADF&G Kodiak office computer printout DFG 58 run date 5/6/80. Both release and recovery shell-aging done by ADF&G personnel. Usually the ADF&G person tagging and releasing the crab did not recover the same crab.

NOTE: Overall percent error = 9% (i.e. 219 out of 2,575 crabs recovered were shell-aged differently when recovered compared to when they were released).

Table 9. Commercial catch and catch composition of red king crabs by season 1960-82, Registration Area K, Kodiak, Alaska.

Fishing Season			Minimum Legal Size	Harvest		Number of Crab		Postrecruits	
				tonnes		Percent of Harvest		Percent	
Year	Opened	Closed[1]		x 10^3	lb x 10^6	Recruits[2]	Postrecruits	New-shell	Old-shell
1960/61	July 1	June 30	6-1/2"	9.6	21.1	5	95	49	51
1961/62	July 1	June 30	6-1/2"	13.1	29.0	25	75	75	25
1962/63	July 1	June 30	6-1/2"	17.1	37.6	22	78	38	62
1963/64	July 1	June 30	7"	17.1	37.7	35	65	74	26
1964/65	July 1	June 30	7"	18.9	41.6	48	52	74	26
1965/66	July 1	April 30	7"	42.8	94.4	35	65	80	20
1966/67	July 1	April 30	7"	33.5	73.8	29	71	69	31
1967/68	July 1	April 30	7"	19.7	43.4	30	70	59	41
1968/69	June 15	March 31	7"	8.3	18.2	60	40	54	46
1969/70	Aug. 15	Jan. 15	7"	5.5	12.2	55	45	57	43
1970/71	Aug. 15	Jan. 15	7"	5.3	11.7	44	56	42	58
1971/72	Aug. 15	Oct. 29	7"	4.9	10.9	71	29	51	49
1972/73	Aug. 15	Oct. 13	7"	7.0	15.5	46	54	39	61
1973/74	Aug. 15	Oct. 25	7"	6.5	14.4	46	54	39	61
1974/75	Aug. 15	Sept. 21	7"	9.7	21.4	53	47	56	44
	Oct. 15	Jan. 15	8"	1.0	2.2	4	96	64	36
	Total			10.7	23.6	42	58	54	46
1975/76	Aug. 15	Oct. 20	7"[3]	9.8	21.6	44	56	40	60
	Oct. 20	Dec. 1	8"[3]	1.1	2.5	4	96	60	40
	Total			10.9	24.1	36	64	46	54
1976/77	Sept. 1	Oct. 16	7"	6.7	14.8	33	67	45	55
	Dec. 1	Jan. 15	8"	1.4	3.1	1	99	67	33
	Total			8.1	18.0	26	73	50	50
1977/78	Sept. 15	Nov. 30	7"	5.3	11.7	38	62	45	53
	Dec. 1	Jan. 15	8"	0.8	1.8	1	99	57	43
	Total			6.1	13.5	34	66	49	51
1978/79	Sept. 10	Nov. 30	7"	4.7	10.3	48	52	55	45
	Dec. 1	Jan. 15	7-1/2"	0.8	1.7	25	75	57	43
	Total			5.5	12.0	45	55	55	45
1979/80	Sept. 10	Nov. 30	7"	6.1	13.4	75	25	54	46
	Dec. 1	Jan. 15	7-1/2"	0.5	1.2	39	61	67	33
	Total			6.6	14.6	70	30	58	42
1980/81	Sept. 15	Nov. 30	7"	8.3	18.4	69	31	65	35
	Dec. 1	Jan. 15	7-1/2"[4]	0.9	2.1	22	78	86	14
	Total			9.2	20.4	62	38	72	28
1981/82	Sept. 15	Dec. 15	7"	9.2	20.3	55	45	71	29
	Dec. 15	Jan. 15	7-1/2"	1.8	3.9	7	93	85	15
	Total			10.0	24.2	59	41	70	30
1982/83	Sept. 15	Dec. 10	7"	3.4	7.5	46	54	70	30
	Dec. 10	Dec. 19	7-1/2"	0.5	1.1	19	81	71	29
	Total			3.9	8.7	43	57	70	30

[1]Season closure date is the date the last area was closed (i.e. in some years some areas were closed before others).

[2]For this table, recruits are defined as newshell legal crab ≤153 mm or ≤165 mm carapace lengths for the minimum width size limits of 165.1 mm (6 1/2") and 177.8 mm (7") respectively.

[3]Marmot Bay, Chiniak Bay and Kupreanof Strait did not open for 196 mm (8") crab.

[4]Uganik Bay, Kupreanof Strait, Marmot Bay, Chiniak Bay, Ugak Bay, South Sitkalidak Strait, Kiliuda Bay and Alitak Bay did not open for 183.4 mm (7½") crab.

Table 10. Red king crabs commercial harvest by stock and season (A), versus estimated harvest from catch sampling (B), Registration Area K, Kodiak, Alaska (weights in thousands).

Fishing Season		STOCK I tonnes	STOCK I lb	STOCK II tonnes	STOCK II lb	STOCK III tonnes	STOCK III lb	STOCKS IV-VII tonnes	STOCKS IV-VII lb	TOTAL tonnes	TOTAL lb	% ERROR TOTALS (B)÷(A)
1960/61	(A)	1,134	2,500	3,358	7,406	3,544	7,815	1,517	3,344	9,553	21,065	
	(B)	No Sampling		3,294	7,263	3,553	7,834	No Sampling		10,342	22,800	
Difference		-	-	64	143	-9	-19	-	-	-789	-1,735	8.2
1961/62	(A)	2,078	4,581	3,961	8,735	4,244	9,359	2,852	6,288	13,135	28,963	
	(B)	No Sampling		3,430	7,562	3,913	8,628	2,485	5,479	11,672	25,733	
Difference		-	-	531	1,173	331	731	367	809	1,463	3,230	11.2
1962/63	(A)	4,652	10,258	5,504	12,137	4,994	11,011	1,914	4,221	17,064	37,627	
	(B)	No Sampling		No Sampling		4,673	10,301	No Sampling		13,901	30,647	
Difference		-	-	-	-	321	710	-	-	3,163	6,980	18.6
1963/64	(A)	7,474	16,480	5,576	12,296	2,542	5,605	1,512	3,335	17,105	37,716	
	(B)	No Sampling		5,732	12,636	2,480	5,466	1,610	3,550	16,511	36,401	
Difference		-	-	-156	-340	62	139	-98	-215	594	1,315	3.5
1964/65	(A)	6,155	13,571	9,870	21,764	1,570	3,461	1,271	2,801	18,865	41,597	
	(B)	6,245	13,769	9,761	21,519	1,559	3,437	1,364	3,008	18,547	40,886	
Difference		-90	-198	109	245	11	24	-93	-207	318	711	1.8
1965/66	(A)	10,416	22,967	26,142	57,643	5,459	12,036	810	1,785	42,826	94,431	
	(B)	10,016	22,081	26,578	58,593	5,297	11,678	844	1,861	43,175	95,183	
Difference		400	886	-436	-950	162	358	-34	-76	-349	-752	8.0
1966/67	(A)	7,128	15,717	17,785	39,215	7,058	15,563	1,507	3,323	33,478	73,818	
	(B)	7,008	15,451	18,195	40,112	7,136	15,733	1,705	3,759	33,739	74,381	
Difference		120	266	-410	-897	-78	-170	-198	-436	-261	-563	7.6
1967/68	(A)	4,327	9,540	3,804	8,387	9,579	21,122	1,995	4,399	19,704	43,448	
	(B)	5,104	11,252	4,074	8,981	9,912	21,853	No Sampling		20,201	44,536	
Difference		-777	-1,712	-270	-594	-333	-731	-	-	-497	-1,088	2.5
1968/69	(A)	2,138	4,715	2,145	4,730	2,771	6,109	1,205	2,657	8,259	18,211	
	(B)	2,184	4,814	2,233	4,922	2,678	5,904	1,169	2,578	8,418	18,558	
Difference		-46	-99	-88	-192	93	205	36	79	-159	-347	1.9
1969/70	(A)	1,472	3,246	1,430	3,153	1,432	3,157	1,200	2,645	5,533	12,201	
	(B)	1,501	3,308	1,415	3,119	1,407	3,102	1,241	2,736	5,610	12,369	
Difference		-29	-62	15	34	25	55	-41	-91	-77	-168	1.4
1970/71	(A)	1,425	3,143	1,912	4,216	906	1,998	1,075	2,370	5,319	11,728	
	(B)	1,522	3,355	1,951	4,301	896	1,975	1,043	2,299	5,547	12,230	
Difference		-97	-212	-39	-85	10	23	32	71	-228	-502	4.3
1971/72	(A)	299	659	2,077	4,533	2,326	5,174	238	525	4,939	10,891	
	(B)	330	728	2,059	4,540	2,282	5,032	239	527	5,048	11,128	
Difference		-31	-69	18	-7	44	142	-1	-2	-109	-237	2.2

(continued)

Table 10. (p. 2 of 2)

Fishing Season		STOCK I tonnes	STOCK I lb	STOCK II tonnes	STOCK II lb	STOCK III tonnes	STOCK III lb	STOCKS IV-VII tonnes	STOCKS IV-VII lb	TOTAL tonnes	TOTAL lb	% ERROR TOTALS (B)÷(A)
1972/73	(A)	472	1,040	2,994	6,601	3,104	6,844	451	995	7,020	15,480	
	(B)	476	1,049	2,941	6,483	3,055	6,735	433	954	7,097	15,645	
Difference		-4	-9	53	118	49	109	18	41	-77	-165	1.1
1973/74	(A)	748	1,649	3,581	7,897	1,856	4,093	344	759	6,529	14,397	
	(B)	707	1,559	3,723	8,207	1,808	3,987	330	727	6,546	14,431	
Difference		41	90	-142	-310	48	106	14	32	-17	-34	2.4
1974/75	(A)	2,116	4,666	3,798	8,374	4,220	9,304	580	1,278	10,713	23,622	
	(B)	2,023	4,461	3,905	8,610	4,055	8,940	532	1,173	10,246	22,590	
Difference		93	205	-107	-236	165	364	48	105	467	1,032	4.4
1975/76	(A)	3,514	7,748	2,276	5,019	4,309	9,502	813	1,793	10,912	24,062	
	(B)	3,354	7,394	2,271	5,008	4,297	9,472	820	1,807	10,827	23,868	
Difference		160	354	5	11	12	30	-7	-14	85	194	0.8
1976/77	(A)	3,124	6,888	2,049	4,517	2,439	5,377	541	1,192	8,151	17,974	
	(B)	3,199	7,053	2,102	4,634	2,525	5,566	591	1,302	8,543	18,835	
Difference		-75	-165	-53	-117	-86	-189	-50	-110	-392	-861	4.8
1977/78	(A)	1,366	3,013	1,588	3,501	2,902	6,399	268	591	6,124	13,504	
	(B)	1,248	2,751	1,599	3,526	2,912	6,420	268	592	6,105	13,460	
Difference		118	262	-11	-25	-10	-21	0	-1	19	44	0.3
1978/79	(A)	829	1,829	912	2,012	3,395	7,485	316	696	5,452	12,022	
	(B)	818	1,804	934	2,058	3,323	7,327	305	672	5,493	12,110	
Difference		11	25	-22	-46	72	158	11	24	-41	-88	0.7
1979/80	(A)	1,060	2,337	762	1,680	4,368	9,631	436	961	6,625	14,609	
	(B)	980	2,160	788	1,738	4,266	9,404	415	915	6,459	14,240	
Difference		80	177	-26	-58	102	227	21	46	166	369	2.6
1980/81	(A)	2,105	4,642	1,640	3,617	4,627	10,203	901	1,986	9,274	20,449	
	(B)	2,096	4,622	1,666	3,673	4,656	10,266	865	1,908	9,358	20,631	
Difference		9	20	-26	-56	-29	-63	36	3,894	-84	-182	0.9
1981/82	(A)	4,332	9,553	2,981	6,574	2,932	6,464	747	1,647	10,992	24,238	
	(B)	4,275	9,425	3,039	6,702	2,882	6,354	756	1,667	10,969	24,183	
Difference		57	128	-58	-128	50	110	-9	-20	23	55	<0.1
1982/83	(A)	2,140	4,719	869	1,916	512	1,129	426	940	3,948	8,705	
	(B)	2,071	4,567	889	1,960	497	1,096	426	939	3,855	8,500	
Difference		69	152	-20	-44	15	33	0	1	93	205	2.4

[1]Data from fish tickets (Table 4) and estimated weights based on explanding commercial length frequency catch samples to the number of crab harvested and applying a length-weight function (Blau 1988).

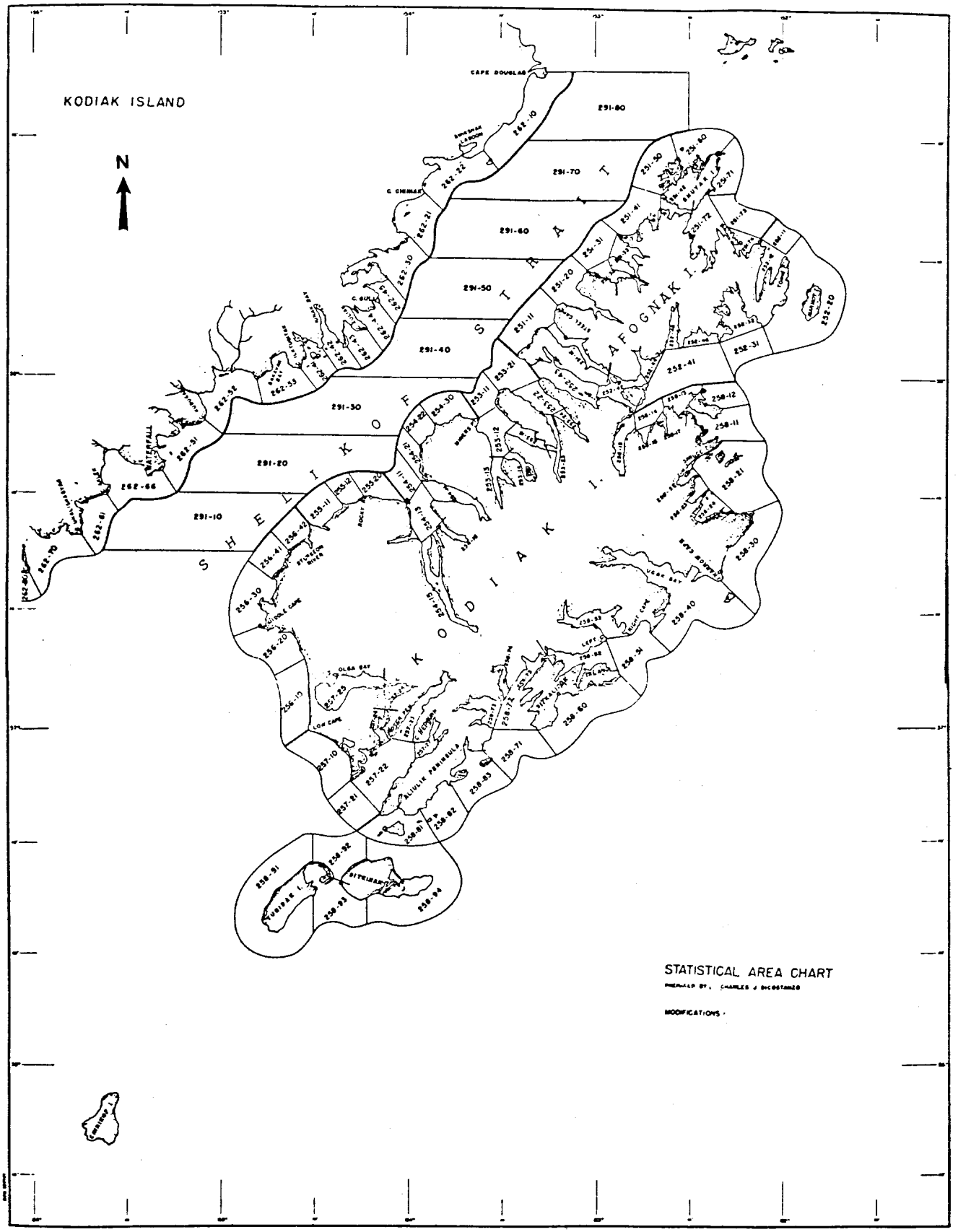

Figure 1. Statistical chart used to assign commercial catches to geographic areas, January 1955 - May 1961, Registration Area K, Kodiak, Alaska. (Note: The westernmost portion of the Kodiak Registration Area is not shown on this chart.)

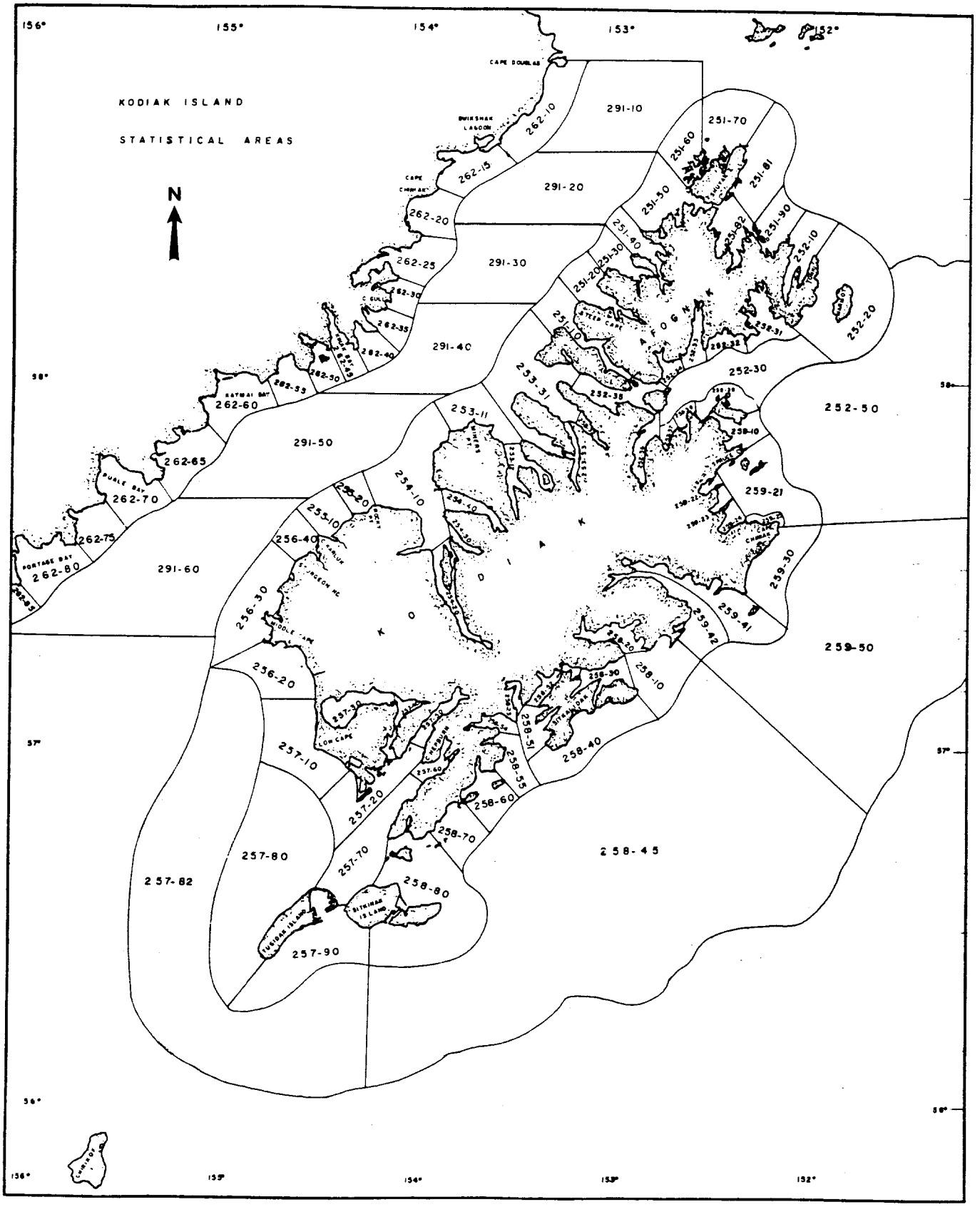

Figure 2. Statistical chart used to assign commercial catches to geographic areas, June 1961 - May 1963, Registration Area K, Kodiak, Alaska. (Note: The westernmost portion of the Kodiak Registration Area is not shown on this chart.)

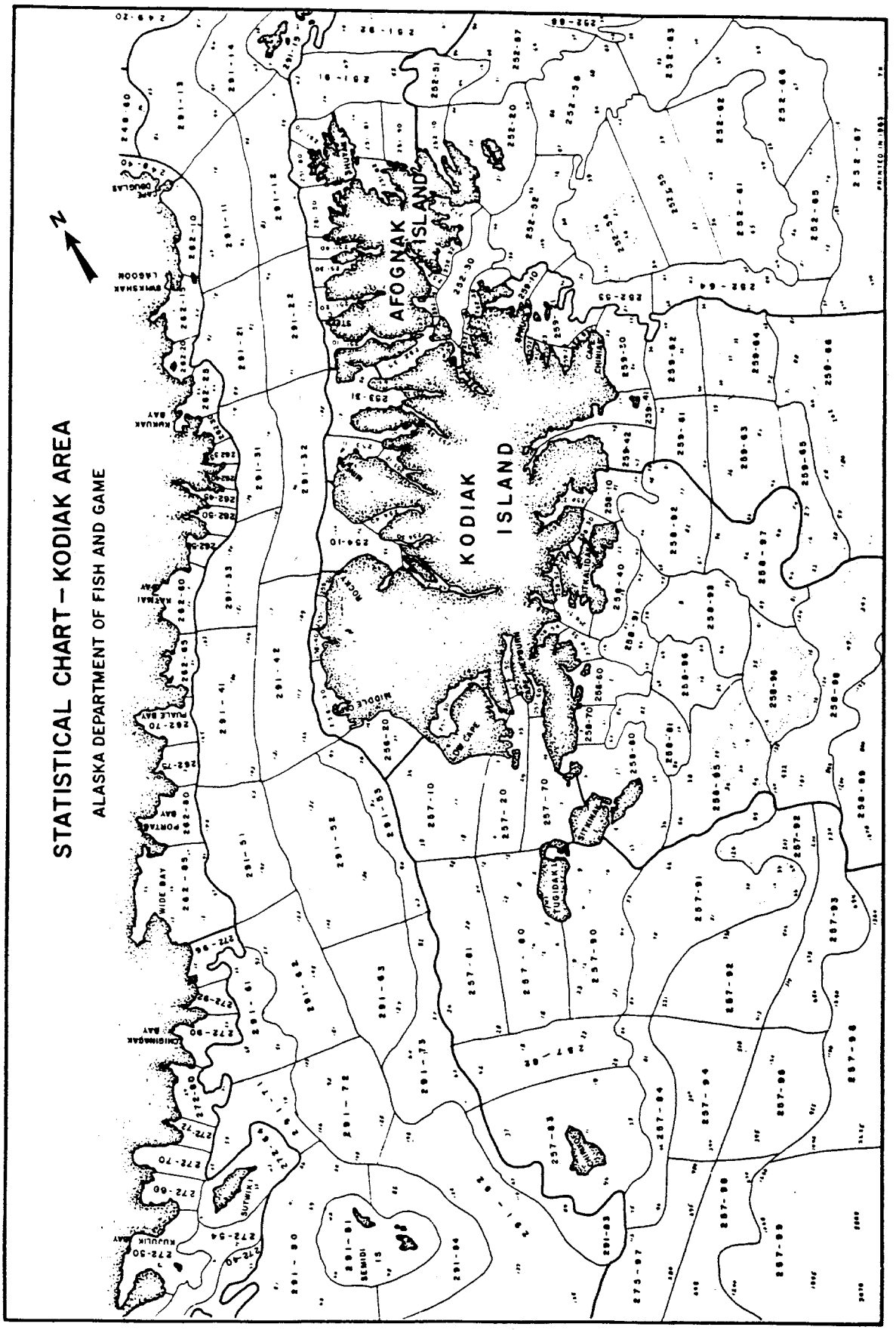

Figure 3. Statistical chart used to assign commercial catches to geographic areas, June 1963 - December 1964, Registration Area K, Kodiak, Alaska.

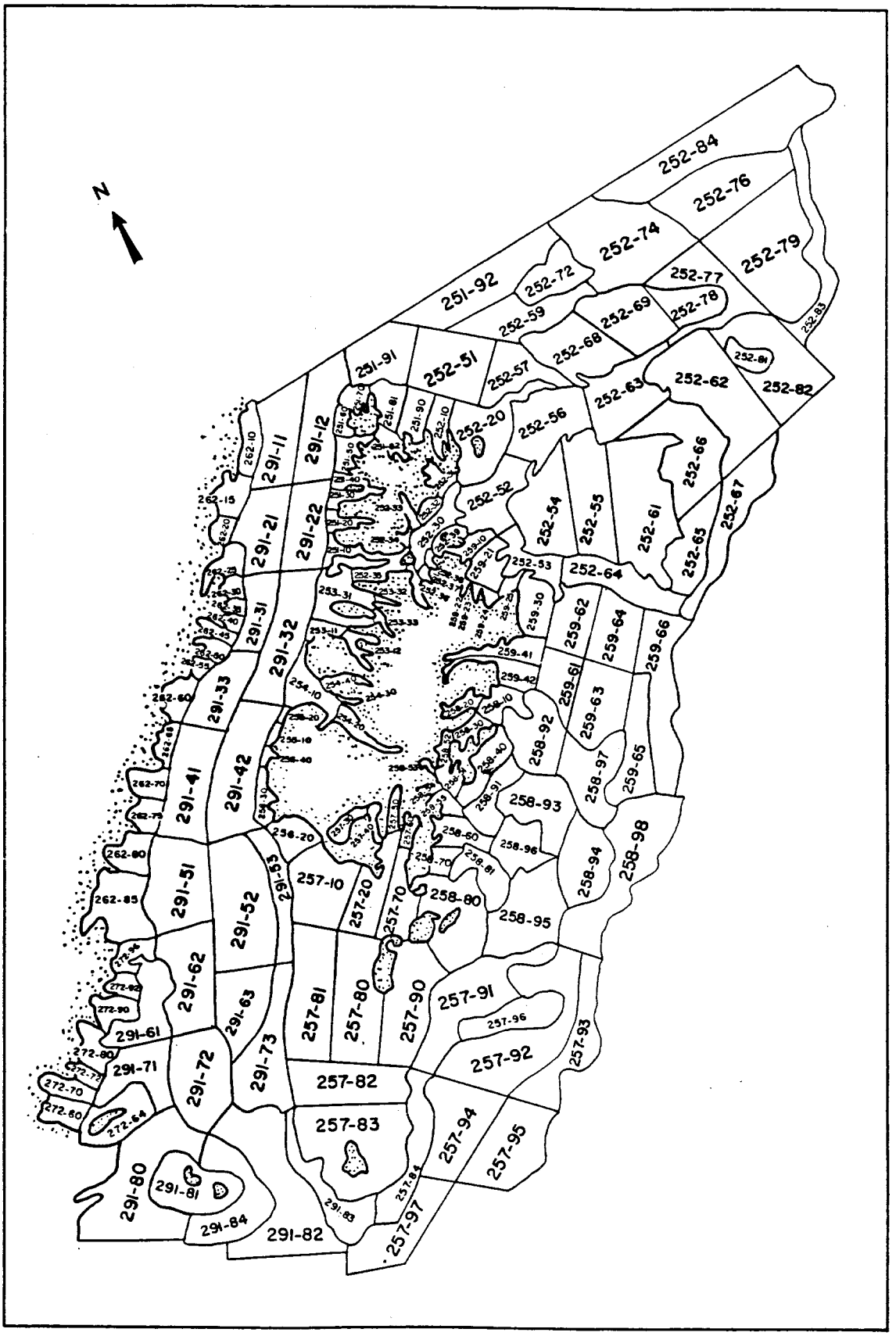

Figure 4. Statistical chart used to assign commercial catches to geographic areas, January 1965 - July 1973, Registration Area K, Kodiak, Alaska.

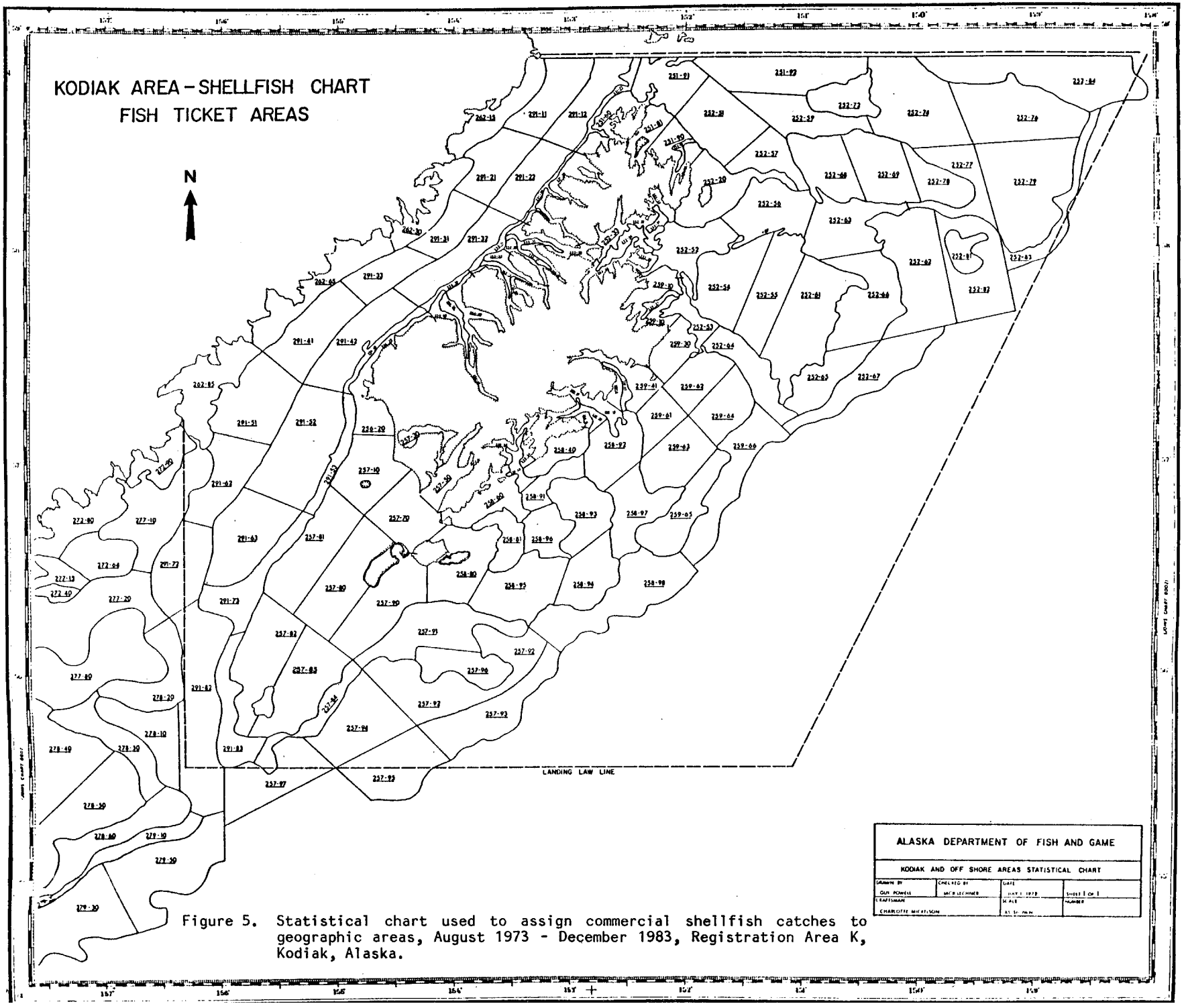

Figure 5. Statistical chart used to assign commercial shellfish catches to geographic areas, August 1973 - December 1983, Registration Area K, Kodiak, Alaska.

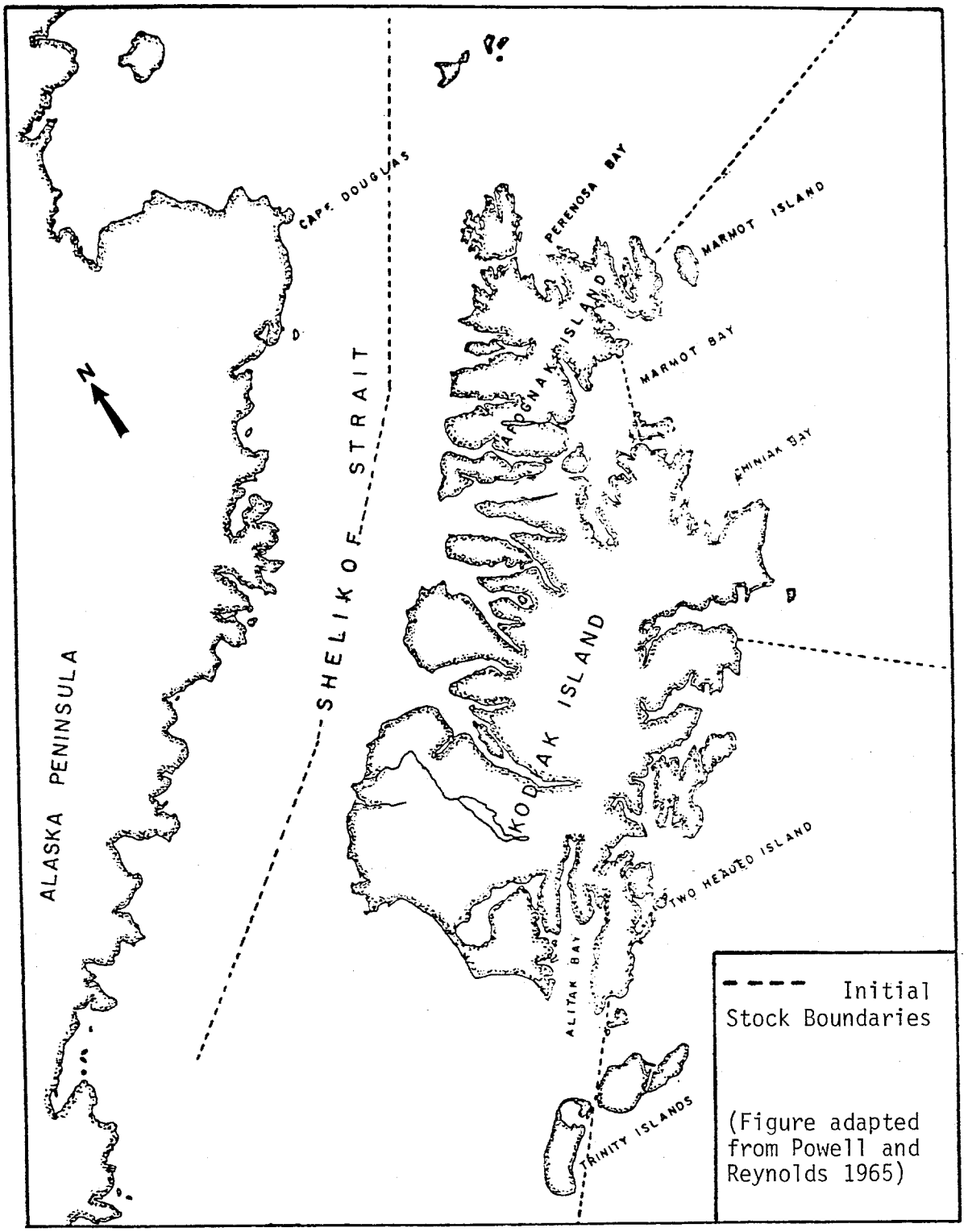

Figure 6. First chart delineating red king crab stocks around the Kodiak Archipelago based on crab movements from tag recoveries.

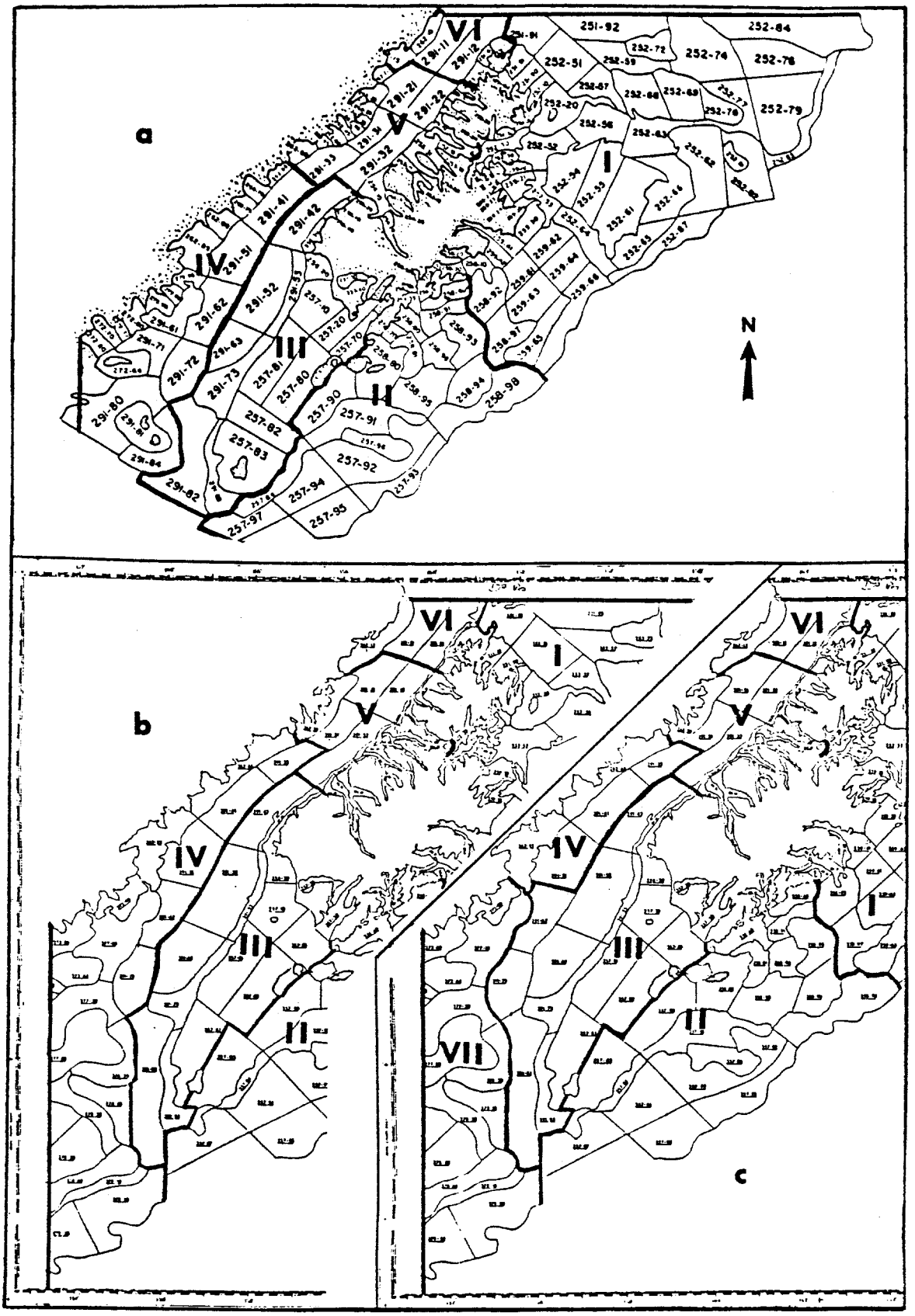

Figure 7. Red king crab stock boundaries as defined for the following periods: a) 1965 - July 1973; b) August 1973 - December 1976; and c) January 1977 to present, Registration Area K, Kodiak, Alaska. Roman numerals are stock numbers and darkened lines are stock boundaries.

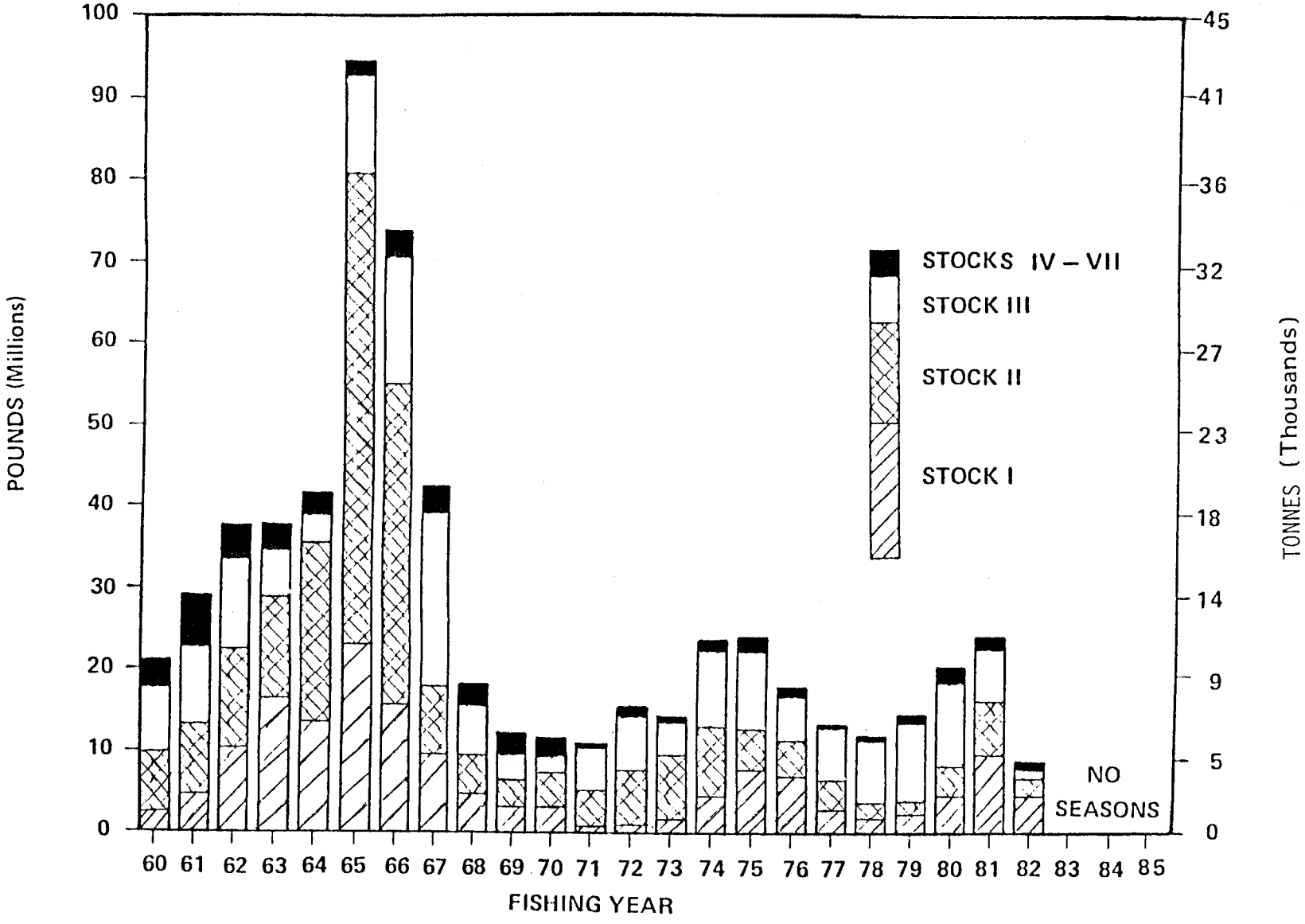

Figure 8. Commercial red king crab catch by stock and season total 1960-85, Registration Area K, Kodiak, Alaska.

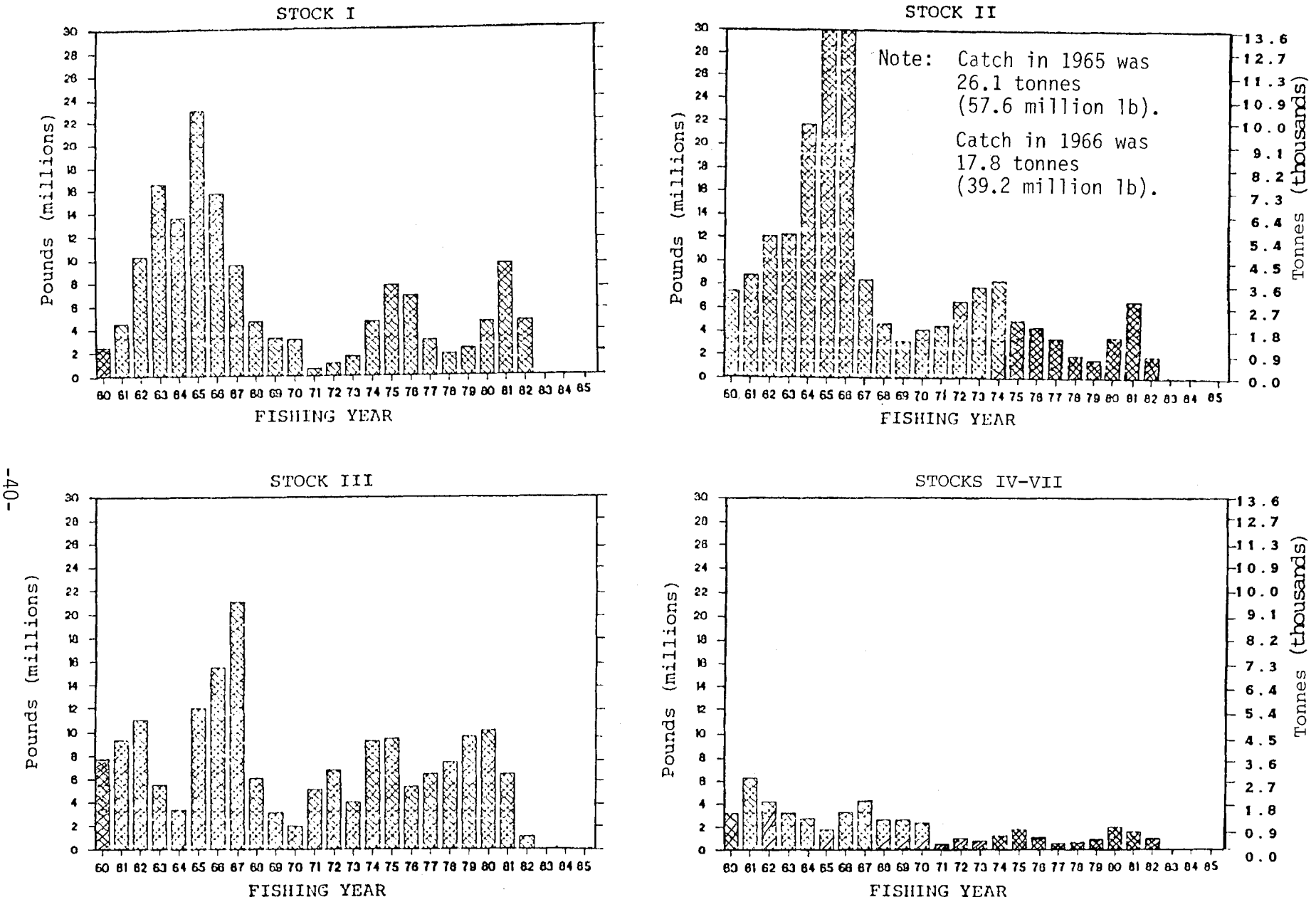

Figure 9. Commercial harvest of red king crab by individual stock 1960-85, Registration Area K, Kodiak, Alaska.

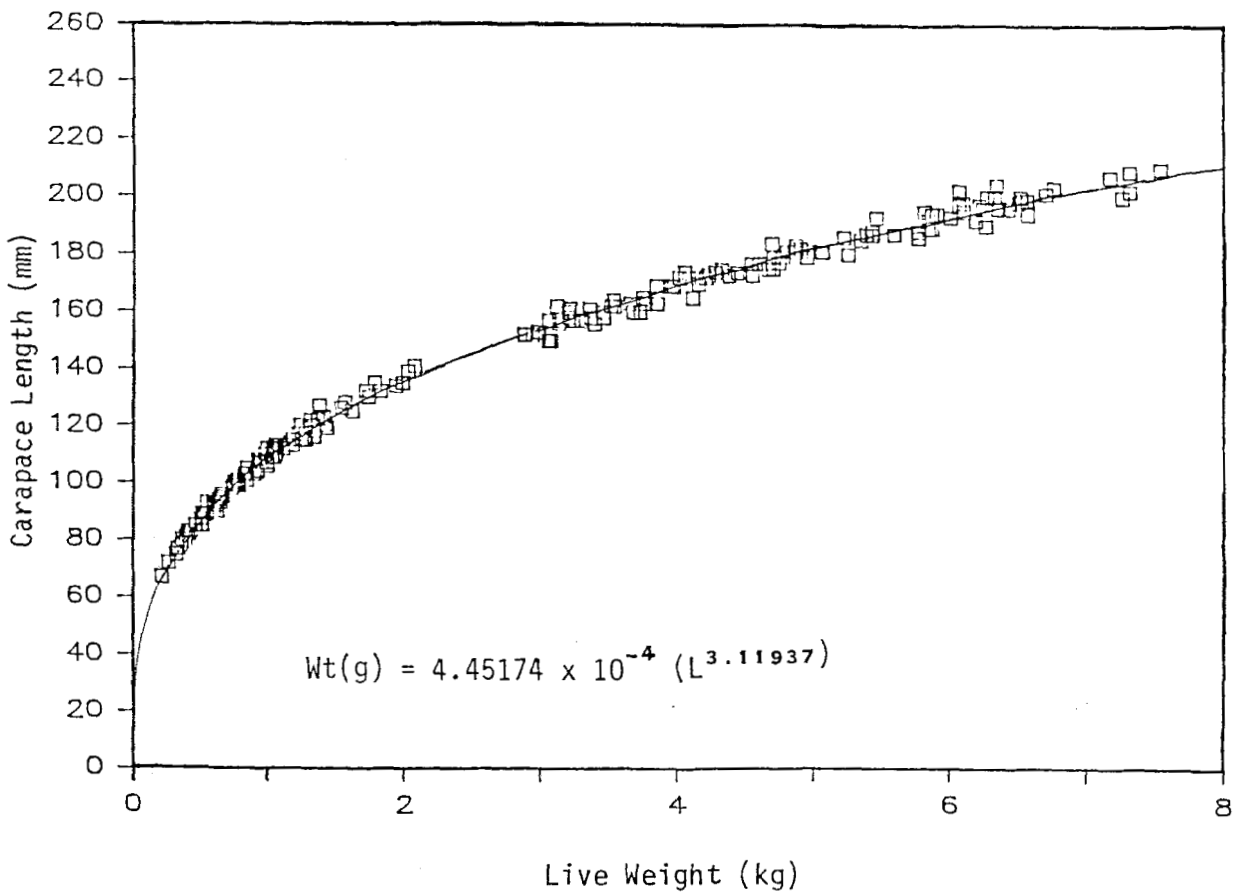

Figure 10. Length-weight relationship of male red king crab based on analysis of 218 carapace length vs weight measurements of crab taken from Chiniak Bay in the fall of 1963.